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INITIAL ASSESSMENT STUDY OF SEWELLS POINT NAVAL COMPLEX NORFOLK, VIRGINIA

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INITIAL ASSESSMENT STUDY
SEWELLS POINT NAVAL COMPLEX (SPNC)
NORFOLK, VA.

February 1983

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Prepared for:

NAVY ASSESSMENT AND CONTROL
OF INSTALLATION POLLUTANTS (NACIP) DEPARTMENT
Naval Energy and Environmental Support Activity (NEESA)
Port Hueneme, Calif. 93043

EXECUTIVE SUMMARY

This report presents the results of an Initial Assessment Study (IAS) conducted at Sewells Point Naval Complex (SPNC). The purpose of an IAS is to identify and assess sites posing a potential threat to human health or the environment due to contamination from past hazardous materials operations.

Based on information from historical records, aerial photographs, field inspections, and personnel interviews, a total of 18 potentially contaminated sites were identified at SPNC. Each of the sites was evaluated with regard to contamination characteristics, migration pathways, and pollutant receptors.

The study concludes that, while none of the sites poses an immediate threat to human health or the environment, six warrant further investigation under the Navy Assessment and Control of Installation Pollutants (NACIP) Program to assess potential long-term impacts. A Confirmation Study, involving actual sampling and monitoring of the six sites, is recommended to confirm or deny the existence of the suspected contamination and to quantify the extent of any problems which may exist. The six sites recommended for confirmation are listed below in order of priority:

1. Camp Allen Landfill, Site 1.

2. CD Landfill, Site 6.

3. Q Area Drum Storage Yard, Site 3.

4. Transformer Storage Area, Site 4.

5. Slag Pile, Site 2.

6. Pesticide Disposal Site, Site 5.

The results of the Confirmation Study will be used to evaluate the necessity of conducting mitigating actions or cleanup operations.

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FOREWORD

The Navy Assessment and Control of Installation Pollutants (NACIP) Program was promulgated by OPNAVNOTE 6240 of 11 Sep 1980 and Marine Corps Order 6280.1 of 30 Jan 1981. The purpose of the Program is to systematically identify, assess, and control contamination from past hazardous material operations which pose a potential threat to human health or the environment.

An Initial Assessment Study (IAS) was performed at Sewells Point Naval Complex (SPNC), Norfolk, Va., by a team of specialists under contract to the Naval Energy and Environmental Support Activity (NEESA), Port Hueneme, Calif. Further confirmation studies under the NACIP Program are recommended at several areas at the activity. Sections dealing with significant findings, conclusions, and recommendations are presented in the earlier section of the report. The later technical sections provide more in-depth discussions on important aspects of the study.

For further information, contact the Officer in Charge, 112N, Naval Energy and Environmental Support Activity (NEESA), Port Hueneme, Calif. 93043; AUTOVON 360-3351 or commercial 805-982-3351.

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ACKNOWLEDGEMENTS

The Initial Assessment Study (IAS) at the Sewells Point Naval Complex (SPNC) could not have been accomplished within its short timeframe without the support and cooperation of numerous Navy and civilian personnel. In particular, the IAS team expresses its sincere gratitude to CDR Richard Lines, Civil Engineer Corps (CEC), Base Civil Engineer, Naval Base Norfolk (NAVBASE NORFOLK) and to J.G. Wallmeyer, S.G. Olson, P.A. Rakowski, and J.R. Bailey of the Atlantic Division, Naval Facilities Engineering Command (LANTNAVFACENGCOM), Code 114.

INITIAL ASSESSMENT STUDY
OF SEWELLS POINT NAVAL COMPLEX

SECTION 1.0
INTRODUCTION

1.1 PURPOSE OF THE INITIAL ASSESSMENT STUDY

As directed by the Chief of Naval Operations (CNO), the Naval Energy and Environmental Support Activity (NEESA) conducts Initial Assessment Studies (IASs) to collect and evaluate evidence indicating the existence of pollutants which may have contaminated a site and which may pose an imminent health hazard to people located on or off the installation. These studies represent the first phase of the Navy Assessment and Control of Installation Pollutants (NACIP) Program, which is designed to:

- Identify any environmental contamination resulting from past hazardous material storage, handling, and waste disposal operations at shore installations;

- Assess the impact, or potential for impact, of the contamination on public health and the environment, both at the installation and in surrounding civilian communities; and

- Provide corrective measures, as needed, to prevent contamination from causing any adverse effects on public health or the environment.

1.2 AUTHORITY

The CNO initiated the NACIP Program through OPNAVNOTE 6240 ser 45/733503 of 11 Sep 1980.

1.3 SEQUENCE OF EVENTS

1. Sewells Point Naval Complex (SPNC) was approved for an IAS by CNO letter 451/397464 of 3 Aug 1981.

2. The Commander in Chief, U.S. Atlantic Fleet (CINCLANTFLT), Commander, Naval Base Norfolk (COMNAVBASE NORFOLK), and the Commander of the Naval Sea Systems Command (NAVSEASYSCOM) were notified by NEESA of the selection of SPNC for an IAS. The NACIP Program Management Plan, the IAS Statement of Work, and Activity Support Requirements for the IAS were forwarded to the installation to outline assessment scope, provide guidelines to personnel, and request advance information for review by the IAS team.

3. SPNC and Atlantic Division, Naval Facilities Engineering Command (LANTNAVFACENGCOM) personnel were briefed by a NEESA representative, Mr. Wallace Eakes, on 13 Apr 1982, prior to the IAS.

4. Various Government agencies were contacted for documents pertinent to the IAS effort. Agencies contacted include:

   a. NEESA Information Management Department and Services Department, Port Hueneme, Calif.

   b. Naval Facilities Engineering Command (NAVFACENGCOM) Historical Office, Port Hueneme, Calif.

   c. Virginia Department of Conservation and Economic Development, Division of Mineral Resources, Charlottesville, Va.

   d. U.S. Soil Conservation Service (USSCS), Richmond, Va., and Virginia Agricultural Experiment Station (VAES), Richmond, Va.

   e. U.S. Geological Survey (USGS), Arlington, Va.

   f. The National Archives and Records Service, General Services Administration, Cartographic Branch, Pennsylvania Ave. at 8th St. NW, Washington, D.C.

   g. The National Archives, Record Group 80--CNO and Group 71--Bureau of Yards and Docks, Washington, D.C.

   h. The National Archives, Record Group 181--Naval Districts and Shore Establishments, Suitland, Md.

   i. Navy History Office, Washington Navy Yard, Washington, D.C.

   j. LANTNAVFACENGCOM Facilities Planning and Real Estate Department and Facilities Management Department, Norfolk, Va.

   k. Ordnance Environmental Support Office (OESO), Indian Head, Md.

   l. NAVSEASYSCOM Documents Branch, Alexandria, Va.

   m. NAVSEASYSCOM Safety Office, Alexandria, Va.

   n. Department of Defense Explosives Safety Board (DDESB), Alexandria, Va.

o. U.S. Army Corps of Engineers (COE), Norfolk District, Norfolk, Va.

5. The onsite phase of the IAS was conducted from 10-21 May 1982. The information presented in this report is current, as of the date of the onsite search. The following personnel from ESE, under contract No. N62474-82-C-8284, were assigned to the IAS team:

   Dr. Bruce McMaster, Chemist, Project Manager
   Mr. Russell Bowen, Civil Engineer, Team Leader
   Mr. Stephen Denahan, Hydrogeologist
   Mr. William Fraser, Environmental Engineer
   Mr. Ernest Frey, Civil Engineer
   Mr. Paul Geiszler, Chemist/Ecologist
   Ms. Carla Jones, Historian/Document Coordinator

6. In addition to records reviews, interviews were conducted with current and former employees. Ground and aerial tours of the installation were made, and photographs were taken. The use of "Personal Communication" as a reference citation in this report identifies information received via interviews or through unpublished reports such as interoffice memoranda. Information received from an interview was generally verified by one or more additional interview(s) or by comparison with documented data. In particular, substantiation was obtained for interview data impacting conclusions and recommendations.

A listing of the abbreviations, short titles, and acronyms used herein appears in appendix A.

1.4 SUBSEQUENT NACIP STUDIES

The second phase of the NACIP Program is the Confirmation Study. During confirmation, extensive sampling and monitoring are conducted to confirm or refute the existence of suspected migrating contamination at sites identified during an IAS. If significant impacts on public health or the environment are found to exist, the study recommends remedial actions to be taken.

A Confirmation Study is recommended only if the following circumstances exist:

1. Sufficient evidence exists to suspect that the activity is contaminated, <u>and</u>

2. The contamination presents a potential danger to:

   a. The health of civilians in nearby communities or personnel within the activity fenceline, or to

   b. The environment within or outside the installation.

Further studies are not conducted under the NACIP Program if these criteria are not met.

SECTION 2.0
SIGNIFICANT FINDINGS

This section summarizes the significant findings of the Initial Assessment Study (IAS) at Sewells Point Naval Complex (SPNC) with regard to the installation's geohydrology and the characteristics of specific waste disposal and spill sites on the installation.

Regarding geohydrology, those aspects which are most relevant to potential contaminant migration pathways and potential receptors of contaminants are summarized. In addition, existing water quality data that may relate to contaminant migration are discussed.

The characteristics of waste storage, disposal, and spill sites are described on a site-by-site basis, summarizing those findings which are most significant with respect to the presence of toxic or hazardous contaminants.

2.1 GEOHYDROLOGY

The soils at SPNC consist of unconsolidated fine sands and silts of low to moderate permeabilities and are underlain by relatively impermeable sediments consisting of silt, clay, and sandy clay. These strata have a combined thickness of about 60 feet, with the bottom 20 to 40 feet consisting of the relatively impermeable sediments. The upper layer of unconsolidated soils comprises the water table aquifer, which is discontinuous. Depth to ground water is generally less than 8 feet.

The lower layer of relatively impermeable sediments overlies a deeper confined aquifer, known as the Yorktown Formation. This aquifer is generally isolated from the overlying water table aquifer because of the low permeability of the silt, clay, and sandy clay beds which separate the two aquifers. However, in some areas, the confining beds are absent. This condition exists in the Camp Allen area, apparently as a result of a former channel of Boush Creek that cuts through the confining beds. Boush Creek no longer exists in the Camp Allen area, because it was filled in during past construction. Consequently, contamination of the shallow aquifer in the Camp Allen area could result in potential pollutant migration to the deeper Yorktown Aquifer.

Four nonpotable water supply wells are located at SPNC, one of which is located near the Camp Allen landfill (site 1), and draw water mainly from the shallow aquifer. The depths of these wells range from 85 to 110 feet; these wells are used for lawn watering and vehicle washing and are not intended for potable water supply. Two other wells which draw water from the Yorktown Aquifer are located just west of SPNC. These wells provide 90,000 to 100,000 gallons per day of nonpotable process (cooling) water for the Sheller-Globe plant, which manufactures cork gaskets (Siudyla et al., 1981).

There are also seven monitoring wells located in and around the former Camp Allen landfill (site 1). These wells have been used to collect ground water samples periodically since 1974. The analytical results for these wells are addressed in section 2.2.1, Camp Allen Landfill (site 1), and are discussed in detail in section 6.5.1.2, Ground Water.

Surface waters at SPNC consist of Mason Creek and the remnants of Boush Creek, the main channel of which was completely filled and replaced by a network of drainage ditches during the development of SPNC. The final reach of Mason Creek traverses SPNC in an underground culvert and discharges to Willoughby Bay.

Stormwater runoff from the highly developed portion of the installation is collected by a network of inlets to underground culverts, which convey the water to Mason Creek or directly to Willoughby Bay or the Elizabeth River. Due to the proximity of these tidal surface waters and the low relief of the land surface, both Mason Creek and the remnant tributaries of Boush Creek are tidal throughout SPNC.

Water quality in the estuarine area surrounding SPNC, including the Elizabeth River and Willoughby Bay, reflects the stressed environmental conditions caused by numerous local sewage and industrial discharges, particularly those upstream from SPNC on the Elizabeth River. Because the majority of the wastewater discharges have been to the Elizabeth River upstream from SPNC, water quality degradation is more evident in the Elizabeth River than in Willoughby Bay. Elevated levels of nitrogen, phosphorus, and fecal coliforms have been measured in the Elizabeth River. In addition, elevated metals levels are found in the waters and bottom sediments of the Elizabeth River, as well as Willoughby Bay. Nearly all the estuarine area surrounding SPNC is closed to shellfishing (oysters and clams) because of the degraded water quality resulting from municipal and industrial point and nonpoint sources, along with shipping and shipping-related activities.

Although SPNC activities have contributed to the stressed environmental conditions, it is virtually impossible to determine the extent to which SPNC activities have contributed to these conditions because of the numerous other sources of contamination that have existed in the past in the area. The discharge of industrial wastewaters from SPNC in the past contributed to metals contamination in Willoughby Bay. Industrial wastewater discharges to Willoughby Bay are addressed in section 2.2.13, Past Industrial Wastewater Outfalls, and are discussed in detail in section 6.4.1.3, Industrial Wastewater.

2.2 WASTE DISPOSAL SITES

During the installation visit, the IAS team identified 18 sites of concern with regard to potential contamination. The locations of these 18 sites are identified in figure 2.1-1. Table 2.1-1 summarizes some of the significant aspects of each of these sites. A brief description of the characteristics of each of the 18 sites is included in the following subsections.

2.2.1 Camp Allen Landfill (Site 1)

The Camp Allen landfill (site 1) was used for the disposal of wastes generated at SPNC from the early 1940s until about 1974. Prior to the landfilling activities, the Camp Allen area was utilized as a source of borrow material. In the mid-1940s, an incinerator was constructed just south of the current location of the brig (Bldg. CA-484) to burn combustible wastes. This incinerator operated until the mid-1960s. Materials too bulky for the incinerator were burned in the landfill. Ash from the incineration of solid wastes, as well as fly and bottom ash from the power plant (Bldg. P-1), was also landfilled. In addition to these wastes, metals plating, parts cleaning and paint stripping sludges, overage chemicals, various chlorinated organic solvents, acids, caustics, paints, paint thinners, pesticides, asbestos, scrap metal, and construction and demolition debris were disposed of in this landfill. Many of these wastes were hauled from the Camp Allen salvage yard located next to the landfill.

Based on industrial waste generation rates, it is estimated that approximately 40,000 pounds of metals plating sludge, 60,000 pounds of parts cleaning sludge, and 400,000 pounds of paint stripping residue have been disposed of in the Camp Allen landfill (site 1). Although quantities are unknown for the other wastes identified above, they are likely to be significant due to the length of operation of this landfill.

In 1971, a fire occurred in the northern portion of the salvage yard where waste lubricating oil, organic solvents, paints, paint thinners, acids, caustics, and pesticides were stored pending disposal. The fire reportedly was caused by incompatible storage of chemicals. The burned and, reportedly, smoldering residue from the fire, as well as the above-mentioned materials, were buried in the area just east and northeast of the salvage yard. This operation was a trench-type landfill. The trenches were reportedly about 150 feet long, 6 to 8 feet deep, and 10 feet wide.

The Camp Allen landfill (site 1), including the burial site of wastes from the above-mentioned salvage yard fire, encompasses an area of approximately 45 acres. The majority of the site is currently covered with grass, and the brig (Bldg. CA-484) and a heliport have been constructed over a portion of the landfill. The landfill is rimmed with tidal drainage ditches which convey stormwater runoff from the area.

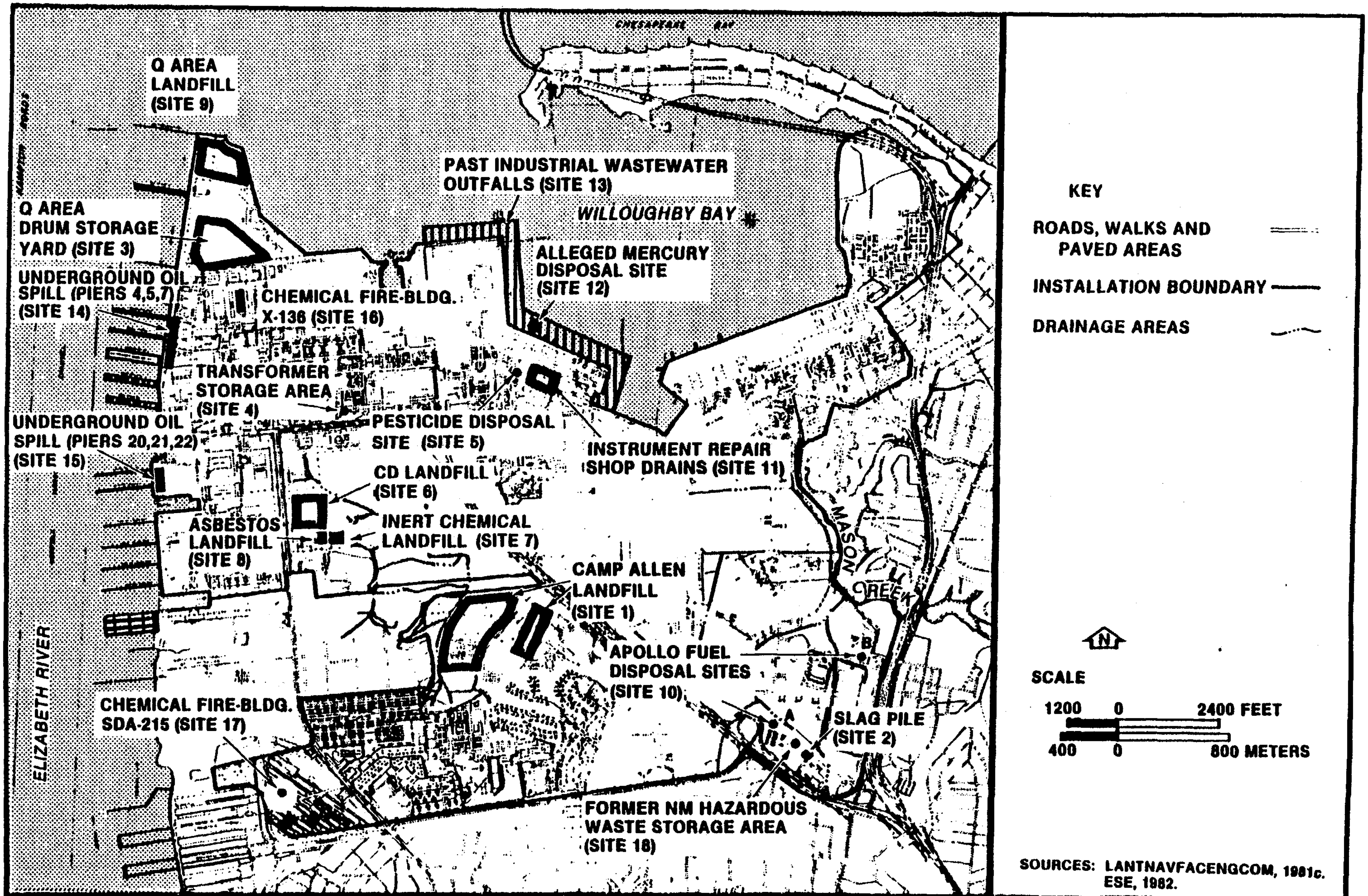

Figure 2.1-1
MAP OF POTENTIAL CONTAMINATION SITES

INITIAL ASSESSMENT STUDY
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Table 2.1-1
Disposal Sites Investigated at SPNC

Site Number	Site Name	Map Coordinates*	Period of Operation	Type of Waste Disposed Of	Comments
1	Camp Allen Landfill	N225 E2643	1940s to 1974	Ash from solid waste incineration, coal fly and bottom ash, asbestos, waste oil, organic solvents, paint stripping wastes, metals plating sludges, overage chemicals, pesticides, scrap metal, construction and demolition debris	Total landfill area is about 45 acres; landfill currently covered with grassy areas, brig, and heliport
2	Slag Pile	N222 E2650	1950s to 1960s	Slag from aluminum smelting operation	Slag pile covers an area of about 2 acres
3	Q Area Drum Storage Yard	N234 E2636	1950s to present	Predominantly POL and various organic solvents; some pesticides, formaldehyde, acids	Unbermed earthen yard; numerous leaking drums; saturated soil in portion of yard where leaking drums are stored
4	Transformer Storage Area	N229 E2640	1940s to 1978	Transformer oil potentially containing PCBs	Open earthen storage yard; transformer oil reportedly drained onto ground surface; evidence of past spillage

Table 2.1-1
Disposal Sites Investigated at SPNC
(Continued, Page 2 of 4)

Site Number	Site Name	Map Coordinates*	Period of Operation	Type of Waste Disposed Of	Comments
5	Pesticide Disposal Site	N231 E2643	Late 1960s to 1973	Pesticide rinsewater and concentrates	Approximately 100 gallons of rinsewater discharged to french drain weekly; intermittent discharges of pure strength pesticides; pesticides included chlordane, malathion, and DDT
6	CD Landfill	N228 E2639	1974 to 1982	Construction debris, coal fly ash and bottom ash, and drums of cadmium dust	Significant quantities (up to 1,500 cubic yards) of cadmium dust generated by sandblasting operation
7	Inert Chemical Landfill	N227 E2639	June 1979	84 pallets of inert chemicals; 1-foot clay base and 6-foot clay side berms	Mainly unused ion exchange resin; State-approved disposal
8	Asbestos Landfill	N227 E2639	June 1979	6,500 bags of asbestos (double bagged); 1-foot base and 6-foot clay side berms	Asbestos; State-approved disposal
9	Q Area Landfill	N235 E2636	1974 to 1978	Construction debris	Fill operation and burn dump; no evidence of hazardous waste disposal
10	Apollo Fuel Disposal Sites	N222 E2650 N224 E2651	1967 to 1969	Monomethylhydrazine	Waste fuel was poured on the ground surface at each site and allowed to percolate into soil

Table 2.1-1
Disposal Sites Investigated at SPNC
(Continued, Page 3 of 4)

Site Number	Site Name	Map Coordinates*	Period of Operation	Type of Waste Disposed Of	Comments
11	Instrument Repair Shop Drains	N231 E2644	1940s to 1956	Low-level radium waste	Unknown quantities flushed down sink, contaminating plumbing; site is currently being cleaned up, and contaminated materials are being hauled offsite for disposal
12	Alleged Mercury Disposal Site	N232 E2644	Late 1960s	Elemental mercury	150 glass containers (10 pounds each) reportedly dumped off seawall; no evidence of disposal found in probing bottom sediments or in chemical analysis of sediments
13	Past Industrial Wastewater Outfalls	N232 E2644	1940s to 1976	Metals plating solutions and rinsewaters, paint stripping solutions, degreasing compounds	Discharged to storm drains leading to Willoughby Bay; bottom sediment data indicate metals contamination; discharges currently routed to IWTP and then to sanitary sewer system
14	Underground Oil Spill—Piers 4, 5, and 7	N232 E2635	1979	Diesel oil	Oil seepage to Elizabeth River; french drains installed to collect oil; approximately 50,000 gallons of oil removed
15	Underground Oil Spills—Piers 20, 21, and 22	N226 E2636	1979	Diesel oil	Intermittent oil seepage to Elizabeth River; minor contamination of soil

Table 2.1-1
Disposal Sites Investigated at SPNC
(Continued, Page 4 of 4)

Site Number	Site Name	Map Coordinates*	Period of Operation	Type of Waste Disposed Of	Comments
16	Chemical Fire—Bldg. X-136	N233 E2637	18 Jul 1979	Calcium hypochlorite and acids	Reportedly caused by incompatible chemical storage; approximately 2 tons of calcium hypochlorite flushed down storm sewer leading to Elizabeth River; no reports of adverse water quality impacts
17	Chemical Fire—Bldg. SDA-215	N221 E2638	12 Aug 1981	Calcium hypochlorite and acids	Reportedly caused by incompatible chemical storage; considerable site contamination resulted; site was decontaminated; contaminated wastes were hauled offsite for disposal
18	Former NM Hazardous Waste Storage Area	N222 E2650	1975 to 1979	Numerous drums containing waste oil, metals plating solutions and sludges, organic solvents, paint stripping wastes	Considerable past leakage and spillage of hazardous wastes; a landfill permit has been obtained for this site from the Virginia SDH; the permit conditions include a continuing monitoring program

* Map coordinates correspond to State planar coordinates on Naval Facilities Engineering Command (NAVFACENGCOM) Drawing No. 4066294 [Atlantic Division, NAVFACENGCOM (LANTNAVFACENGCOM), 1981c].

POL = petroleum, oil, and lubricants.
PCBs = polychlorinated biphenyls.
IWTP = industrial waste treatment plant.
SDH = State Department of Health.

Source: ESE, 1982.

Monitoring results for seven ground water monitoring wells located in and around the Camp Allen landfill (site 1) indicate that the Virginia ground water standards for chromium, zinc, lead, and phenol have been slightly exceeded. The wells have been monitored periodically since 1974.

2.2.2 Slag Pile (Site 2)

The slag pile (site 2), which covers an area of about 2 acres, was used for the disposal of slag generated by an aluminum smelting operation conducted in the 1950s and 1960s. The slag pile consists of pieces of various kinds of metal, primarily steel.

2.2.3 Q Area Drum Storage Yard (Site 3)

The Q area drum storage yard is an open earthen yard located in the northwestern corner of SPNC. This area was created by a fill operation conducted in the early 1950s and has been in use since then to store tens of thousands of drums. The drums contain mostly new petroleum products, various chlorinated organic solvents, and paint thinners. Evidence of past spillage (dark stains on soil) was found throughout the storage yard. The northern portion of the yard has been used for storing damaged and leaking drums. The soil in this area was thoroughly saturated with what appeared to be lubricating oil.

2.2.4 Transformer Storage Area (Site 4)

The transformer storage area behind (south) Bldg. P-71 was used to store out-of-service and new transformers from the 1940s until 1978. Transformer oil was reportedly drained from out-of-sevice transformers onto the ground surface in this area. Although much of the area is currently covered with recently laid gravel, the soil in the lowest part of the grade in the storage area is visible and exhibits dark stains, which is evidence of past spillage.

2.2.5 Pesticide Disposal Site (Site 5)

The pesticide disposal site (site 5) consists of a french drain located southeast of Bldg. V-95. The french drain was used for the disposal of pesticide waste generated in the former pest control shop (Bldg. V-95). This shop was in operation from the late 1960s until 1973, and the french drain has not been used for pesticide disposal since 1973. It was reported that approximately 100 gallons per week of pesticide rinse water was disposed of in this french drain, as well as intermittent discharges of overage concentrated pesticides. Pesticides used in this pest control shop included chlordane, malathion, and DDT.

2.2.6 CD Landfill (Site 6)

The CD landfill (site 6) has been used for the disposal of mainly nonputrescible, nonhazardous materials since 1974. Mostly construction and disposal debris and ash from the salvage fuel boiler (Bldg. Z-309) and power plant (Bldg. P-1) at SPNC have been disposed of in this landfill. However, significant quantities of cadmium dust (a maximum of 1,500 cubic yards) from a Naval Air Rework Facility, Norfolk (NAVAIREWORKFAC NORFOLK) sandblasting operation were disposed of at this site from 1974 until 1981. This dust was subjected to the U.S. Environmental Protection Agency (EPA) extraction procedure (EP) toxicity test (EPA, 1981a) and was found to exceed the maximum contaminant level for cadmium. Consequently, the dust is classified as a hazardous waste and has been contract hauled offsite for disposal at an EPA-approved hazardous waste disposal facility since 1981.

2.2.7 Inert Chemical Landfill (Site 7)

The inert chemical landfill (site 7), which is located south of the CD landfill (site 6), was used for a single disposal of overage inert chemicals, primarily unused ion exchange resins. Eighty-four pallets of materials were buried in this landfill on 25 Jun 1979, with the approval of the Solid and Hazardous Waste Management Division, Virginia SDH. This landfill was constructed with a 1-foot clay base and 6-foot clay side berms. The final landfill cover consists of 2 feet of soil capped with 1 foot of clay (LANTNAVFACENGCOM, 1979a).

2.2.8 Asbestos Landfill (Site 8)

The asbestos landfill (site 8), which is located just east of the inert chemical landfill (site 7), was used for the single disposal of asbestos generated during a ship refitting operation. Six thousand five hundred bags (double bagged) of asbestos were buried at this site on 27 Jun 1979, with the approval of the Solid and Hazardous Waste Management Division, Virginia SDH. This landfill was constructed similarly to the inert chemical landfill (site 7) (LANTNAVFACENGCOM, 1979a).

2.2.9 Q Area Landfill (Site 9)

This landfill (site 9) is located on the extreme northwestern end of SPNC in the Q area. This area was formed during a past fill operation. The landfill, which was operated from 1974 until 1978, was used for the disposal of construction debris only.

2.2.10 Apollo Fuel Disposal Sites (Site 10)

During the period 1967 to 1969, two or three Apollo spacecraft capsules were offloaded from aircraft carriers at SPNC. A remaining fuel component, monomethylhydrazine, was drained from the capsules into 55-gallon drums for subsequent disposal. It was reported that three or four drums of the monomethylhydrazine were drained from each capsule and that the fuel component was disposed of by pouring it onto the ground surface, allowing it to percolate into the soil. There were two disposal sites, both of which were located in the naval magazine (NM) area. The first site was located north of the Taussig can area and consisted of a fenced area about 40 feet long and 20 feet wide. Three or four drums of the fuel component were disposed of at this site, and one or two disposals were conducted at this site before it was abandoned. The site was abandoned because of its proximity to a drainage ditch, and the fence was moved from the abandoned site to another site near Bldg. NM-37, where the fence was reconstructed. The disposal procedure practiced at this site was the same as that used at the former site, and one or two disposals of three or four drums each were conducted at this site.

Inspection of both Apollo fuel disposal sites (site 10) indicated that the vegetation was not visibly stressed as a result of the past disposal operations at each of the sites.

2.2.11 Instrument Repair Shop Drains (Site 11)

Unknown quantities of radium wastes from ships' dials were poured down the sink drains in the instrument repair shop located in Bldg. V-60 (site 11). This shop was in operation from the late 1940s until 1956. As a result of pouring the radium wastes down the sink drains, the drain pipes and traps were contaminated. Consequently, the drain traps in Bldg. V-60 were plugged with concrete to avoid flushing the radium to the storm sewer system and ultimately to Willoughby Bay. In May 1982, Chem Nuclear of Barnwell, S.C., was awarded a contract to clean up the low-level radiological contamination in the plumbing of Bldg. V-60, and the cleanup operation has been completed.

2.2.12 Alleged Mercury Disposal Site (Site 12)

Approximately one hundred and fifty 10-pound glass bottles containing elemental mercury were reportedly dumped off the seawall near Bldg. V-88 into Willoughby Bay in the late 1960s (LANTNAVFACENGCOM, 1976b). Subsequently, bottom sediment samples were collected at the site for mercury analysis, and divers probed the sediments for the glass containers in 1976; however, no mercury or containers were detected (LANTNAVFACENGCOM, 1979b).

2.2.13 Past Industrial Wastewater Outfalls (Site 13)

Numerous industrial wastewaters generated by NAVAIREWORKFAC NORFOLK operations were discharged to the storm sewer system and ultimately to Willoughby Bay in the past. These wastewaters included metals plating solutions and rinse waters, parts cleaning solutions, and paint stripping wastewater and were a source of pollution with metals (primarily chromium, cadmium, and zinc); cyanide; oil and grease; and phenols (Wiley and Wilson, 1971) to Willoughby Bay. Available sediment data for Willoughby Bay [Storage and Retrieval (STORET)] (EPA, 1982) indicates metals contamination. In the mid-1970s, many of the industrial waste streams were rerouted to the IWTP, which was constructed to serve as a centralized pretreatment facility, with the effluent being discharged to the Hampton Roads Sanitation District (HRSD) sewage treatment plant (STP). About 100,000 gallons per day have been rerouted to the IWTP since it began operation in 1976, and the discharges from the storm sewer system in the NAVAIREWORKFAC NORFOLK area to Willoughby Bay have been permitted under the National Pollutant Discharge Elimination System (NPDES). These discharges consist primarily of stormwater runoff, steam condensate, and noncontact cooling water.

2.2.14 Underground Oil Spill--Piers 4, 5, and 7 (Site 14)

The seepage of an estimated 100 gallons per day of oil from behind the seawall near piers 4, 5, and 7 (site 14) to the Elizabeth River was detected in 1979. It was determined that oil had accumulated behind the seawall in these pier areas as a result of leaks in the pier fuel distribution system. A french drain was installed behind the seawall in this area to recover the oil, and approximately 50,000 gallons of oil was recovered from the french drain system using pumps (Environmental Resources Management, Inc., 1980). The french drain is periodically inspected for the accumulation of additional oil, but it was reported that none has been detected (Personal Communication, 1982).

2.2.15 Underground Oil Spill--Piers 20, 21, and 22 (Site 15)

An intermittent oil seepage from behind the seawall near piers 20, 21, and 22 (site 15) to the Elizabeth River was detected in 1979. Although the soils behind the seawall were contaminated with oil, no free oil was found. The contaminated soils were removed, and no seepage of additional oil from behind the seawall has been detected since 1979.

2.2.16 Chemical Fire--Bldg. X-136 (Site 16)

On 18 Jul 1979, a chemical fire occurred in Bldg. X-136 (site 16) as a result of incompatible chemical storage, predominantly of calcium hypochlorite and acids. During the firefighting operation, approximately 2 tons of calcium hypochlorite was flushed down the storm drain with water and ultimately to the Elizabeth River. The Virginia State Water Control Board (SWCB) was notified of this flushing procedure, and no subsequent adverse water quality impacts to the Elizabeth River were observed (LANTNAVFACENGCOM, 1979c).

2.2.17 Chemical Fire--Bldg. SDA-215 (Site 17)

On 12 Aug 1981, a chemical fire occurred in cell 6 of Bldg. SDA-215 (site 17) as a result of incompatible chemical storage, predominantly of calcium hypochlorite and acids. Considerable site contamination resulted from the fire and fire-extinguishing operation. However, the site was cleaned up by removing remaining hazardous chemicals and residues, as well as contaminated soil adjacent to Bldg. SDA-215. These materials were contract hauled offsite to an EPA-approved hazardous waste disposal facility.

2.2.18 Former NM Hazardous Waste Storage Area (Site 18)

The NM hazardous waste storage area was used from 1975 until 1979 to store drums of hazardous wastes, consisting mainly of waste oil, metals plating solutions and sludges, various chlorinated organic solvents [including trichloroethylene (TCE) and 1,1,1-trichloroethane], acids, and paint stripping solutions. The storage area was an open earthen yard located east of the large metal storage buildings, known as the Taussig cans, in the NM area.

Considerable leakage and spillage of waste oil and hazardous wastes onto the ground surface occurred in this area, and a significant intentional spill occurred in July 1979. Consequently, a pit was excavated, and an existing drainage ditch was widened and lengthened to convey waste oil and contaminated stormwater runoff to the unlined pit. Waste oil and contaminated runoff were periodically pumped from the pit into a tank truck, which transported it to the IWTP for treatment (NAVFACENGCOM, 1980).

Sampling and analysis of the soil in the spill area indicated that it was contaminated with metals, primarily chromium and cadmium. However, a sample of the soil was subjected to the EPA EP toxicity test and was found to be nonhazardous. The contaminated soil was then excavated and placed in piles near the spill area (NAVFACENGCOM, 1980). Subsequently, a landfill permit was obtained from the Virginia SDH in October 1980 for the one-time-only disposal of the contaminated soil at this site by grading and seeding it to establish a vegetative cover. In addition, the permit required a continuing monitoring program to determine if contaminant migration is occurring. The continuing monitoring program required the installation of a shallow ground water monitoring well downgradient from the site (northeast of the site), and monthly monitoring of the ground water monitoring well and the creek located north of the site.

Monitoring at the former NM hazardous waste storage area (site 18) is conducted as part of the NAVAIREWORKFAC NORFOLK NPDES monitoring program. Although the NAVAIREWORKFAC NORFOLK NPDES permit expired in December 1979, a new permit is pending. Because NPDES permits typically are issued for consecutive 5-year periods, the expiration date for the pending permit will likely be in late 1984 or early 1985. It was reported that the monitoring program at the former NM hazardous waste storage area (site 18) will continue, at least until the expiration date of the pending NPDES permit.

The continuing monitoring program included the sampling and analysis of water standing in the pit that was excavated in 1979, in lieu of the collection of ground water samples from a monitoring well.

Monthly monitoring of the water standing in the pit for the period of February 1980 through April 1982 indicated that the Virginia ground water standards for cadmium, chromium, cyanide, and phenols were slightly exceeded on a sporadic basis. Monthly monitoring of the creek for the same period indicated sporadic contamination with low levels of cadmium, chromium, cyanide, and phenols. The above-mentioned creek flows to Mason Creek, which discharges into Willoughby Bay.

SECTION 3.0
CONCLUSIONS

This section presents the conclusions of the Initial Assessment Study (IAS) investigation at Sewells Point Naval Complex (SPNC) with regard to installation geohydrology as it relates to potential contaminant migration pathways and receptors and with regard to the potential for contaminant migration from the 18 storage, disposal, or spill sites identified in section 2.2.

3.1 GEOHYDROLOGY

The potential for contaminant migration by both surface and subsurface pathways exists at SPNC. Potential receptors for migrating contaminants at SPNC consist of surface waters and ground waters. Flow in the shallow ground water system is slow due to the level topography and the low to moderate permeability of the sediments. The Elizabeth River and Willoughby Bay, which are the western and northern site boundaries, also form the shallow aquifer system boundaries. In addition, Mason Creek, which forms part of the eastern site boundary, also receives shallow ground water inflow. The final reach of Mason Creek traverses SPNC in an underground culvert and discharges to Willoughby Bay. Consequently, all shallow ground water onsite eventually discharges to the Elizabeth River or Willoughby Bay. Thus, any contaminants disposed of at or near the surface may enter the ground water via leaching and downward migration and may migrate offsite to the Elizabeth River or Willoughby Bay.

In general, the deeper Yorktown Formation is not subject to contamination from the overlying water table aquifer due to the presence of the aquiclude separating the two aquifers. However, contaminants reaching the shallow ground water may migrate to the deeper Yorktown Aquifer in areas of SPNC where the aquiclude, consisting of deposits of low permeability (silt, clay, and sandy clay), is absent. This condition seems to exist in the area of the Camp Allen landfill (site 1), apparently as a result of a former channel of Boush Creek that cuts through the aquiclude of silt, clay, and sandy clay. Consequently, if the shallow ground water were contaminated as a result of past waste disposal practices at the Camp Allen landfill (site 1), the contaminants could migrate to the deeper Yorktown Aquifer.

Any contaminants present at the surface of SPNC could also migrate off the installation to the Elizabeth River or Willoughby Bay via surface pathways. These pathways include the storm sewer system in the highly developed portion of the installation, remnant tributaries of Boush Creek, drainage ditches tributary to Mason Creek, and Mason Creek. Therefore, contaminants could migrate from SPNC to the Elizabeth River or Willoughby Bay via surface or subsurface pathways. As mentioned in section 2.1, the water quality of both the Elizabeth River and Willoughby Bay reflects stressed environmental conditions caused by numerous sewage and industrial discharges, particularly those upstream from SPNC on the Elizabeth River. The discharge of industrial wastewaters from SPNC in the past contributed to the metals contamination of Willoughby Bay. It is virtually impossible to determine the extent to which SPNC activities have contributed to the degradation of surface waters in the area because of the numerous other sources of contamination that have existed in the past in the area, as well as upstream of SPNC on the Elizabeth River and adjoining waterways.

3.2 WASTE DISPOSAL SITES

Each of the 18 waste disposal sites identified by the IAS team was evaluated using a Confirmation Study Ranking System (CSRS) developed by the Naval Energy and Environmental Support Activity (NEESA) for the Navy Assessment and Control of Installation Pollutants (NACIP) Program. The system is a two-step procedure for systematically evaluating a site's potential hazard to human health and to the environment, based on evidence collected during the IAS.

Step 1 of the system is a flowchart which eliminates innocuous sites from further consideration. Step 2 is a rating model which assigns a numerical score, within a range of 0 to 100, to indicate the potential hazard of a site. Scores are a reflection of the characteristics of the wastes disposed of at a site, potential contaminant migration pathways, and possible contaminant receptors on and off the installation. CSRS scores and engineering judgment are then used to evaluate the need for a Confirmation Study, based on the criteria stipulated in section 1.4. A more detailed description of the CSRS is contained in NEESA Report 20.2-042.

Table 3.2-1 summarizes the results of the application of the CSRS to the 18 disposal sites identified at SPNC. Based on this evaluation, 6 of the 18 sites are recommended for Confirmation Studies.

The following sections summarize the relevant conclusions for each waste disposal site, based on best scientific and engineering judgment.

3.2.1 Camp Allen Landfill (Site 1)

Significant quantities of hazardous materials have been disposed of in the Camp Allen landfill (site 1). These materials include sludges from metals plating, parts cleaning, and paint stripping operations, overage chemicals, various chlorinated organic solvents, acids, caustics, paints, paint thinners, pesticides, and asbestos.

Monitoring results for seven ground water monitoring wells located in and around the landfill indicate occasional violations of Commonwealth of Virginia ground water standards for chromium, zinc, silver, lead, and phenols.

Table 3.2-1
Site Recommendations

Site Number	Site Name	Confirmation Study Recommended?	Reason for Not Recommending Confirmation Study
1	Camp Allen Landfill	Yes	—
2	Slag Pile	Yes	—
3	Q Area Drum Storage Yard	Yes	—
4	Transformer Storage Area	Yes	—
5	Pesticide Disposal Site	Yes	—
6	CD Landfill	Yes	—
7	Inert Chemical Landfill	No	Approved by Virginia SDH; clay liner
8	Asbestos Landfill	No	Approved by Virginia SDH; clay liner
9	Q Area Landfill	No	No evidence of hazardous waste disposal
10	Apollo Fuel Disposal Sites	No	Waste biodegradable to form nonhazardous products
11	Instrument Repair Shop Drains	No	Cleanup of contamination has been completed
12	Alleged Mercury Disposal Site	No	Site previously investigated; no contamination detected
13	Past Industrial Wastewater Outfalls	No	Authorized under NPDES permit; contamination reduced significantly by segregation of process waste streams

Table 3.2-1
Site Recommendations
(Continued, Page 2 of 2)

Site Number	Site Name	Confirmation Study Recommended?	Reason for Not Recommending Confirmation Study
14	Underground Oil Spill—Piers 4, 5, and 7	No	Contamination previously cleaned up; no further evidence of leakage
15	Underground Oil Spill—Piers 20, 21, and 22	No	Contamination previously cleaned up; no further evidence of leakage
16	Chemical Fire--Bldg. X-136	No	Contaminants flushed to Elizabeth River; no adverse water quality impacts observed
17	Chemical Fire--Bldg. SDA-215	No	Contamination previously cleaned up
18	Former NM Hazardous Waste Storage Area	No	A landfill permit has been obtained for this site from Virginia SDH; the permit conditions include a continuing monitoring program

-- = Not applicable.
SDH = State Department of Health.
NPDES = National Pollutant Discharge Elimination System.

Source: ESE, 1982.

Contaminants at this site have a high potential for migrating away from the site via the shallow ground water. The drainage ditches that rim the landfill could also serve as a contaminant migration pathway as a result of ground water inflows. These ditches eventually lead to Willoughby Bay.

The exact ground water flow direction at this site is unknown, but it is undoubtedly toward the Elizabeth River or Willoughby Bay, which are both approximately 1 mile from the landfill. The possibility also exists for contaminants to migrate from the shallow ground water to the deeper Yorktown Aquifer, because the deposits of low permeability which generally separate these two aquifers are absent in this area. More importantly, contamination of the ground water at this site could result in the contamination of a nearby (within 200 feet) nonpotable water supply well near Bldg. MCA-600. Although this well is not intended for potable supply, the possibility exists that residents of the nearby housing area may use the water for drinking purposes.

Contamination of the Yorktown Aquifer might result in pollutant migration toward two nonpotable process water wells at the Sheller-Globe plant located just west of SPNC because of potential aquifer drawdown effects. These wells, which are located within 1 mile of the Camp Allen landfill (site 1), draw 90,000 to 100,000 gallons per day from the Yorktown Aquifer.

Considering the quantities of contaminants disposed of at this site, the proximity of the site to potential receptors, the availability of surface and subsurface contaminant migration pathways, and the known existence of contamination at the site and ground water near the site, the potential exists for adverse impacts on human health or the environment.

3.2.2 Slag Pile (Site 2)

The slag pile (site 2), which covers an area of approximately 2 acres, is a potentially minor source of ground water contamination resulting from the leaching and downward migration of metals, primarily chromium, cadmium, and zinc.

Contaminants at this site have a high potential for migrating via the shallow ground water towards Willoughby Bay. In addition, the creek near this site may serve as a contaminant migration pathway resulting from ground water inflows. This creek flows to Mason Creek, which discharges to Willoughby Bay. The flow distance in the creek from the site to Mason Creek is about 1 mile, and the flow distance from the point where this creek enters Mason Creek to Willoughby Bay is about 1 mile.

Considering the quantity of slag present at this site, the proximity of the site to potential receptors, and the availability of surface and subsurface contaminant migration pathways, the potential for adverse impacts on the environment exists.

3.2.3 Q Area Drum Storage Yard (Site 3)

Evidence of considerable leakage and spillage of liquid materials was found in the Q area drum storage yard (site 3) during the onsite IAS survey. This was indicated by dark stains on the soil and soil saturated with what appeared to be oil in the northern portion of the yard.

This site is used to store tens of thousands of drums containing mostly petroleum products, various chlorinated organic solvents, and paint thinners. However, other chemicals, including formaldehyde and pesticides, are stored in this area.

Contaminants at this site have a high potential for migrating to Willoughby Bay and the Elizabeth River, which are within 1,000 feet of the site, via the shallow ground water and stormwater runoff. This contaminant migration could potentially cause adverse impacts on human health or the environment.

3.2.4 Transformer Storage Area (Site 4)

Unknown quantities of transformer oil, potentially containing polychlorinated biphenyls (PCBs), were reportedly drained onto the ground surface in the transformer storage area (site 4). Consequently, the soil at this site is likely contaminated with PCBs and is potentially a source of contamination of the shallow ground water and stormwater runoff from this area. Both the shallow ground water and stormwater runoff are contaminant migration pathways to Willoughby Bay, which is approximately 4,000 feet to the north. Resulting contaminant migration could possibly cause adverse impacts to human health or the environment.

3.2.5 Pesticide Disposal Site (Site 5)

The pesticide disposal site (site 5), which consists of a french drain, received approximately 100 gallons per week of pesticide rinsewater, from the late 1960s until 1973, as well as intermittent discharges of concentrated pesticides. Consequently, the soil adjacent to the french drain is potentially contaminated with pesticides. In addition, the shallow ground water in this area may be contaminated with pesticides. Therefore, pesticides could potentially migrate from this site via the shallow ground water to Willoughby Bay approximately 1,500 feet to the north, which could cause adverse impacts to the environment.

3.2.6 CD Landfill (Site 6)

Although the CD landfill (site 6) has been used mainly for the disposal of construction debris and ash from the salvage fuel boiler

(Bldg. Z-309) and the power plant (Bldg. P-1), it has also been used for the disposal of a maximum of 1,500 cubic yards of cadmium dust contained in drums. This waste is a potential source of ground water contamination resulting from eventual corrosion of the drums and leaching and downward migration of the cadmium. The shallow ground water is a contaminant migration pathway, and, although the exact ground water flow direction in this area is unknown, it is undoubtedly toward the Elizabeth River or Willoughby Bay. The site is approximately 3,000 feet from the Elizabeth River and 1 mile from Willoughby Bay. The drainage ditches near this landfill, which eventually flow into Willoughby Bay, are also a contaminant migration pathway as a result of ground water inflows. Potential contaminant migration via subsurface or surface flows to Willoughby Bay or the Elizabeth River could possibly cause adverse impacts on the environment.

3.2.7 Inert Chemical Landfill (Site 7)

The inert chemical landfill (site 7) is not recommended for further action because of the nonhazardous nature of the materials disposed of and the approval of the site by the Virginia SDH. Furthermore, the construction of this landfill (clay base, side berms, and cap) would most likely prevent contaminant migration.

3.2.8 Asbestos Landfill (Site 8)

The asbestos landfill (site 8) is not recommended for further action, because its construction (clay base, side berms, and cap) would most likely prevent contaminant migration. Furthermore, the site is approved by the Virginia SDH.

3.2.9 Q Area Landfill (Site 9)

The Q area landfill (site 9) is not recommended for further action, because it is unlikely that significant quantities of hazardous wastes were disposed of at this site.

3.2.10 Apollo Fuel Disposal Sites (Site 10)

It is unlikely that the past disposal of the Apollo fuel component (monomethylhydrazine) has resulted in significant contamination. This fuel component has most likely biodegraded over the years to nonhazardous products. Consequently, no further action is recommended for this site.

3.2.11 Instrument Repair Shop Drains (Site 11)

Cleanup of the low-level radium contamination of the drains and plumbing of the instrument repair shop located in Bldg. V-60 (site 11) has been completed. Consequently, no further action is recommended for this site.

3.2.12 Alleged Mercury Disposal Site (Site 12)

The alleged disposal of elemental mercury off the seawall near Bldg. V-88 into Willoughby Bay (site 12) was adequately investigated. No evidence of the alleged mercury disposal was found, and, consequently, no further action is recommended.

3.2.13 Past Industrial Wastewater Outfalls (Site 13)

In the past, the Naval Air Rework Facility, Norfolk (NAVAIREWORKFAC NORFOLK) generated significant quantities of industrial wastewater, which was contaminated primarily with chromium, cadmium, zinc, cyanide, and phenols and was discharged via the storm sewer system to Willoughby Bay. However, this contamination has been significantly reduced by rerouting most of the industrial waste streams to the industrial waste treatment plant (IWTP) for pretreatment prior to discharge to the Hampton Roads Sanitation District (HRSD) sewage treatment plant (STP). The storm sewer outfalls at NAVAIREWORKFAC NORFOLK have been permitted under NPDES. Consequently, the storm sewer outfalls in the NAVAIREWORKFAC NORFOLK area (site 13) are not considered a current source of significant contamination of Willoughby Bay.

3.2.14 Underground Oil Spill--Piers 4, 5, and 7 (Site 14)

The underground oil spill near piers 4, 5, and 7 was cleaned up, and periodic inspection of the site has not detected further accumulation of oil. Consequently, no further action is recommended.

3.2.15 Underground Oil Spill--Piers 20, 21, and 22 (Site 15)

The underground oil spill near piers 20, 21, and 22 was cleaned up, and no further oil seepage has been detected. Consequently, no further action is recommended.

3.2.16 Chemical Fire--Bldg. X-136 (Site 16)

Inspection of the site of the chemical fire in Bldg. X-136 (site 16) during the onsite IAS survey indicated that the site had been adequately cleaned up. Consequently, no further action regarding this site is recommended.

3.2.17 Chemical Fire--Bldg. SDA-215 (Site 17)

The contamination of the site of the chemical fire in Bldg. SDA-215 (site 17), including contaminated soils adjacent to the building, had reportedly been cleaned up and contract hauled offsite for disposal. Since this site has been adequately cleaned up and decontaminated, no further action is recommended.

3.2.18 Former NM Hazardous Waste Storage Area (Site 18)

Leakage and spillage of considerable quantities of hazardous wastes onto the ground surface occurred in the former NM hazardous waste storage area (site 18). These wastes included metal plating solutions and sludges, various organic solvents [including trichloroethylene (TCE) and 1,1,1-trichloroethane], acids, and paint stripping solutions. A significant intentional spillage of hazardous wastes occurred in this area in 1979. Subsequently, a landfill permit was obtained from the Virginia SDH in October 1980 for the one-time-only disposal of contaminated soil, which had been excavated and placed in piles in the area near the spill. The permit required grading and seeding of the contaminated soil to establish a vegetative cover and a continuing monitoring program to determine if contaminant migration was occurring. The continuing monitoring program is in effect at least until early 1985. Monthly monitoring of ground water standing in the shallow pit in this area for the period February 1980 through April 1982 indicated that the Commonwealth of Virginia ground water standards for chromium, cadmium, cyanide, and phenols were slightly exceeded on a sporadic basis. Monthly monitoring of the creek located north of the site for the same period indicated sporadic contamination with low levels of cadmium, chromium, cyanide, and phenols. This suggests that contaminant migration to the shallow ground water and to the creek via shallow ground water inflows may be occurring. However, no confirmation action is recommended, because ongoing monitoring is occurring and because the disposal of the contaminated soil was permitted by the Virginia SDH.

SECTION 4.0
RECOMMENDATIONS

Based on the foregoing significant findings and conclusions, six areas at Sewells Point Naval Complex (SPNC) have significant contamination and a sufficient contaminant migration potential to pose a threat to human health or to the environment, on or off the installation. Additional information regarding the location or extent of the contaminated areas and the potential for contaminant migration is required before the need for further action (if any) can be identified. Therefore, it is recommended that a Confirmation Study, Phase II of the Navy Assessment and Control of Installation Pollutants (NACIP) Program, be performed under contract at SPNC.

Table 4.1-1 identifies the six waste disposal sites at SPNC recommended for confirmation and provides a ranking of their relative risk potentials. Those sites with higher rankings are of more immediate concern (in particular, site 1) and are of higher priority with regard to the need for confirmation.

4.1 CONFIRMATION STUDY

As a result of the Initial Assessment Study (IAS) investigation, the following six waste disposal sites are recommended for Confirmation Study: Camp Allen landfill (site 1), slag pile (site 2), Q area drum storage yard (site 3), transformer storage area (site 4), pesticide disposal area (site 5), and CD landfill (site 6). The specifics of the Confirmation Study regarding each site are provided in the following subsections.

The recommendations presented in this section are intended to be used as a guide in the development and implementation of the Confirmation Study. The recommendations include the approximate number of ground water monitoring wells, type(s) of samples to be taken (such as soil, water, or sediment) and suspected contaminants for which analyses should be conducted. It is recommended that the ground water monitoring program, including monitoring well installation, be accomplished consistent with the guidance provided in the Ground Water Monitoring Guide, Naval Energy and Environmental Support Activity (NEESA) 20.2-031 of March 1981. The number of ground water monitoring wells recommended reflects the number of wells considered to adequately determine whether contaminants are migrating from a given source. The final number of ground water monitoring wells required to determine the extent and movement of contaminants from each site will be determined as part of the Confirmation Study. In all cases where surface water and/or ground water monitoring is proposed, it is recommended that after 1 year of monitoring, the data be evaluated to determine the need for further action, if any.

Table 4.1-1
Summary of Site Recommendations

Site Number	Site Name	CSRS Score	Map Coordinates*		Monitoring Wells	Soil/ Sediment Samples	Water Samples	Laboratory Analytical Parameters
1	Camp Allen Landfill	44	N225	E2643	9	0	48	Priority pollutants†
2	Slag Pile	13	N222	E2650	0	4	4	Metals (Cd, Cr, Zn, Cu, Ni, Be)**
3	Q Area Drum Storage Yard	16	N234	E2636	3	0	12	Oil and grease, volatile organic priority pollutants††, and pesticides/PCBs††
4	Transformer Storage Area	16	N230	E2639	(1)	5	(4)***	PCBs††
5	Pesticide Disposal Site	11	N231	E2643	(1)	5	(4)***	Pesticides††
6	CD Landfill	23	N228	E2638	0	8	8	Cd

Abbreviations:
CSRS = Confirmation Study Ranking System
Cd = cadmium
Cr = chromium
Zn = zinc
Cu = copper
Ni = nickel
Be = beryllium
PCBs = polychlorinated biphenyls

* Map coordinates correspond to State planar coordinates on Naval Facilities Engineering Command (NAVFACENGCOM) Drawing No. 4066294 [Atlantic Division, NAVFACENGCOM (LANTNAVFACENGCOM), 1981c].
† U.S. Environmental Protection Agency (EPA) priority pollutant list (Callahan et al., 1979).
** Metals includes dissolved fraction only for water samples; total metals for sediment samples.
†† Organic compounds included in the indicated fractions of the EPA priority pollutant list (Callahan et al., 1979).
*** Ground water monitoring is recommended only if significant soil contamination is detected.

Source: ESE, 1982.

Table 4.1-1 summarizes the recommended environmental monitoring program for the six sites to be included in the Confirmation Study. Figures 4.1-1 and 4.1-2 identify the approximate locations of the recommended monitoring points. The detailed approach for each area is described in the following paragraphs.

4.1.1 Camp Allen Landfill (Site 1)

Ground water monitoring wells: 9

Surface water sampling points: Three

Type(s) of samples: Ground water and surface water

Number of samples: 48 (36 ground water and 12 surface water)

Frequency: Quarterly for 1 year

Analytical parameters: The initial quarterly samples should be screened for all EPA priority pollutants (Callahan *et al.*, 1979). Subsequent analyses should be limited to those contaminants detected at levels of concern in the initial screening. Regarding metals analyses, it is recommended that only the dissolved metals fraction be analyzed.

Remarks: A network of nine water table aquifer wells is recommended to determine if contaminants are migrating from either of the landfill areas near Camp Allen (figure 4.1-2). It is recommended that the existing shallow monitoring wells in the Camp Allen area not be included in the program due to inadequate location and/or well construction.

It is recommended that seven of the proposed water table aquifer wells be located around the perimeter of the western portion of the landfill. It is necessary to circumscribe the perimeter of this landfill with wells to enhance the possibility of intercepting leachate in any direction. Shallow ground water flow direction from this landfill is difficult to predict due to the generally low topographic gradient in the area and the extent to which the natural flow direction in the area may have been altered by fill activities. Furthermore, it was reported that several smaller subareas exist within the western portion of the landfill at Camp Allen where significant quantities of hazardous materials were disposed of. However, adequate information was not available to specifically identify the location of these smaller subareas and the types of hazardous materials that were disposed of in these areas. Consequently, there are several potential sources of leachate plumes that could be emanating from the landfill. A monitoring system is required that can detect leachate from several such sources. Some of the recommended monitoring wells in figure 4.1-2 are located near the suspected location of these sources.

In addition, it is recommended that one water table aquifer monitor well be installed south of the eastern portion of the Camp Allen

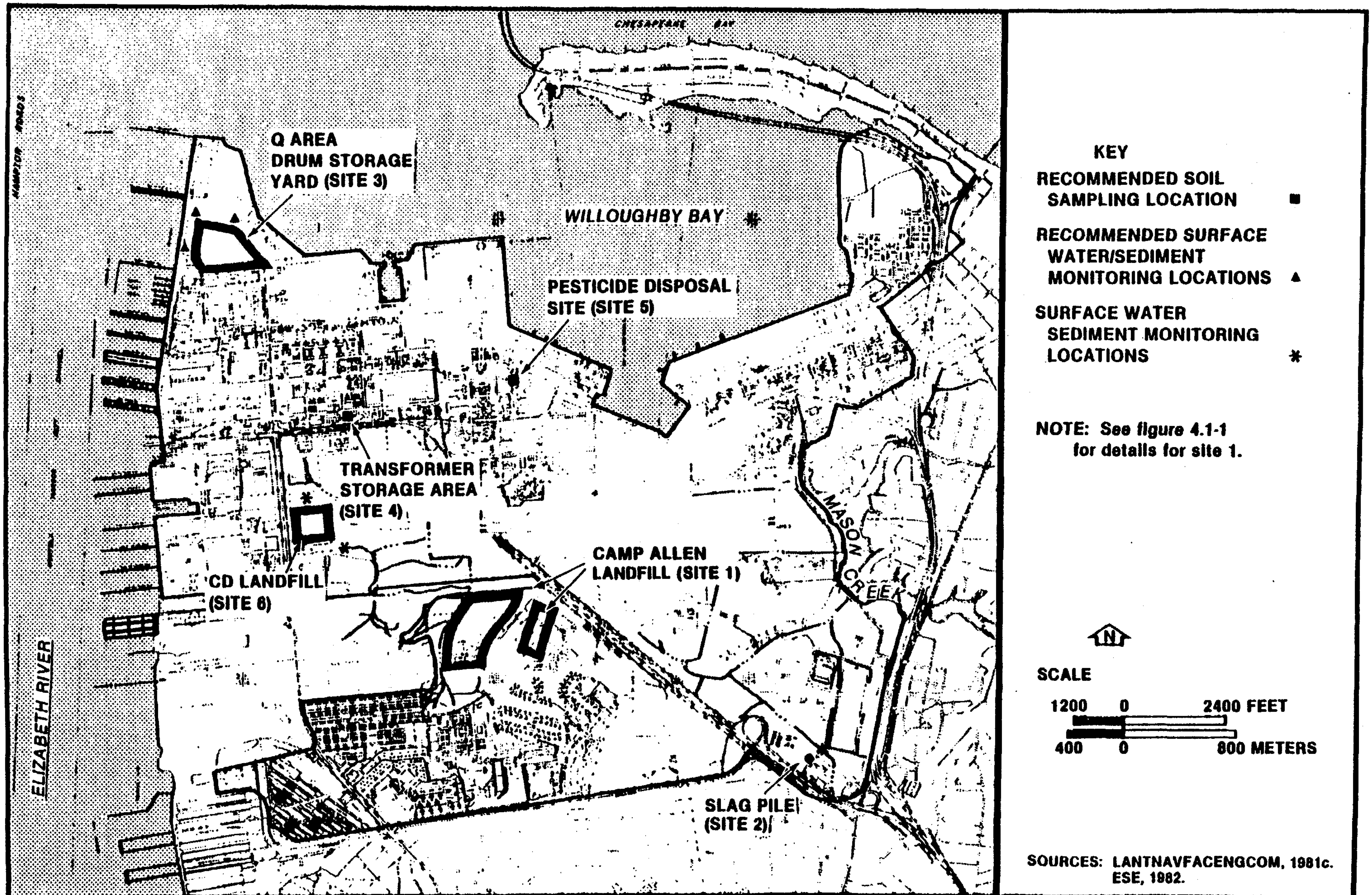


Figure 4.1-1
RECOMMENDED MONITORING PROGRAM

INITIAL ASSESSMENT STUDY
SEWELLS POINT
NAVAL COMPLEX

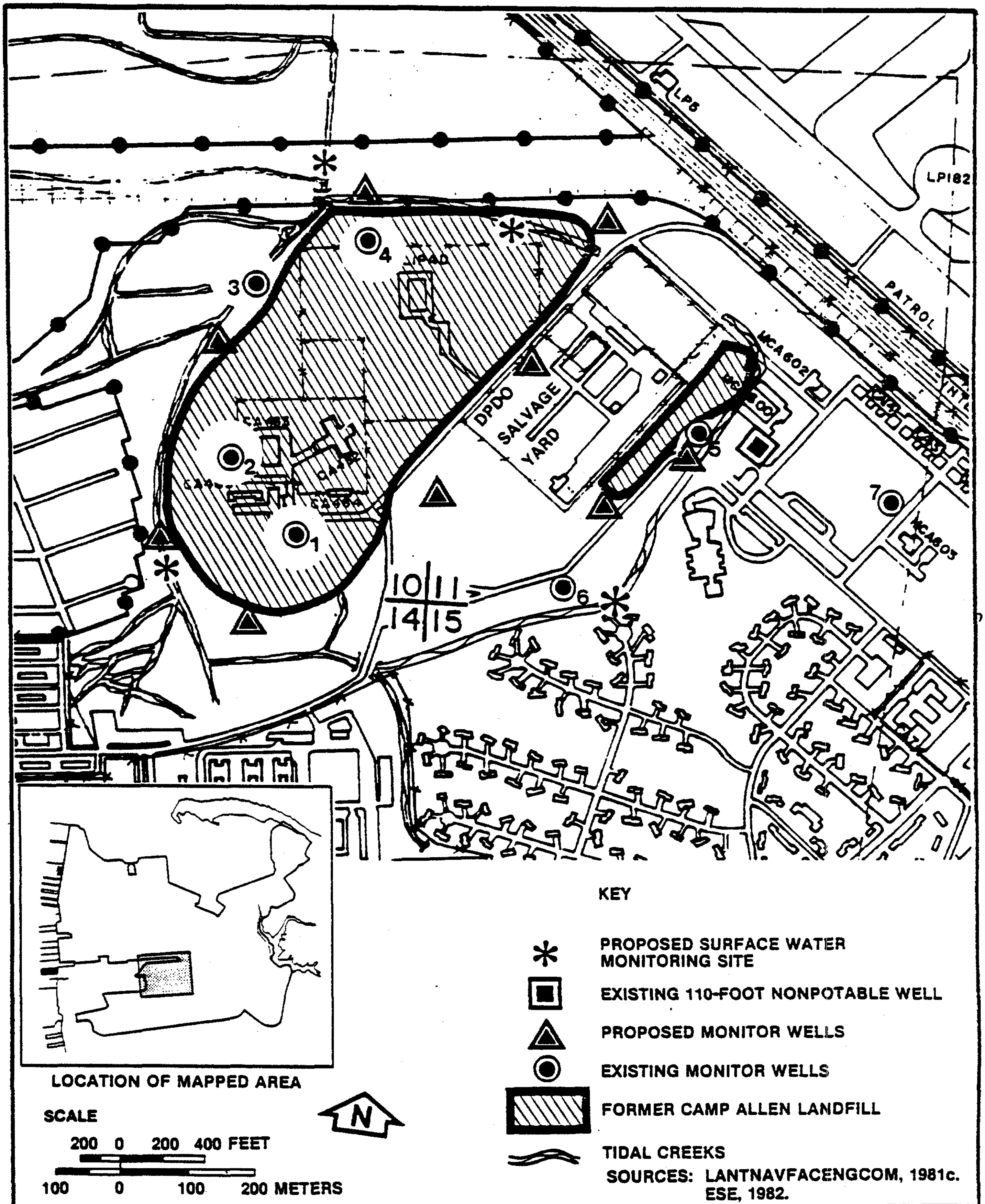


Figure 4.1-2
RECOMMENDED MONITORING PROGRAM — CAMP ALLEN LANDFILL (SITE 1)

INITIAL ASSESSMENT STUDY
SEWELLS POINT
NAVAL COMPLEX

landfill and another be installed east of the eastern portion of the landfill. The wells should be located downgradient from the landfill and as close as possible to its boundary. The recommended locations in figure 4.1-1 are based on an inferred ground water gradient toward the drainage ditch located southeast of the landfill.

The nine water table aquifer monitoring wells should be constructed of 2-inch stainless steel or polyvinyl chloride (PVC) casing and screen and should completely penetrate the water table aquifer (minimum depth approximately equal to 50 feet). They should be screened over the entire saturated zone (and 2 to 3 feet above the water table), based on the seasonal high water table, to allow the collection of a representative sample of the shallow ground water. Filter pack material should be medium-fine sand, and the top of the filter packs should be bentonite sealed, and the annulus should be grouted to the surface. The wells should be protected with a steel casing fitted with a lock for security. All steel casings should be surrounded at the surface by a concrete pad measuring 3 feet square and 6 inches thick. Steel posts or beams painted black and yellow should be installed at the perimeter of each pad as protective markers.

A detailed log of each well boring should be made by a professional geologist, and the horizontal and vertical location of each well should be determined by a registered land surveyor. Undisturbed soil samples (shelby tube) should be taken from each well during drilling and tested to determine vertical permeability. Slug tests should be performed at each well to characterize the horizontal permeability.

Water levels and ground water conductivity and temperature should be measured before and after the development of each well and at the time of sampling. Prior to sampling, three to five well volumes should be purged from each well using a centrifugal pump. Samples should then be collected from each well with a bailer constructed of inert material and dedicated for use in that well.

If contamination is found in the proposed water table aquifer monitoring wells, it is recommended that the existing 110-foot nonpotable water supply well near Bldg. MCA-600 be considered for inclusion in the monitoring program. This well is finished in the Yorktown Aquifer. Thus, this well may be useful to determine if contaminant migration from the Camp Allen landfill to the Yorktown Formation is occurring. Prior to sampling this well, it is recommended that a determination of its construction be made. Special sampling techniques may be required to withdraw a sample from the Yorktown Formation if the well is screened over the entire saturated interval.

It is also recommended that surface water samples be collected from the drainage ditches on or adjacent to the landfill at the approximate locations in figure 4.1-2 to determine if landfill leachate is migrating via surface waters.

4.1.2 Slag Pile (Site 2)

Ground water monitoring wells: None

Surface water/creek sampling points: 1 (see site 2 proposed sampling location, figure 4.1-1)

Type of samples: Surface water/creek sediment

Number of samples: 8 (4 surface water, 4 creek sediment)

Frequency: Quarterly for 1 year

Analytical parameters: Metals (cadmium, chromium, zinc, copper, nickel, and beryllium). It is recommended that only the dissolved metals fraction be analyzed for water samples and total metals be analyzed for sediment samples.

Remarks: One surface water/creek sediment sampling point should be established in the creek to the north of the site. A water and a sediment sample should be collected on a quarterly basis for 1 year. This creek could intercept contamination migrating via either surface runoff or shallow ground water.

4.1.3 Q Area Drum Storage Yard (Site 3)

Ground water monitoring wells: 3

Type of samples: Ground water

Number of samples: 12

Frequency: Quarterly for 1 year

Analytical parameters: Oil and grease, volatile organic priority pollutants (Callahan et al., 1979), pesticides, and PCBs.

Remarks: These wells should be located downgradient of the storage area in the approximate locations identified in figure 4.1-1. One of the three wells should be adjacent to the northwest corner of the storage yard where leaking drums are stored. The wells should completely penetrate the water table aquifer (expected depth of approximately 20 feet) and should be screened over the entire saturated zone (and 2 to 3 feet above the water table), based on the seasonal high water table. The wells should be constructed, logged, and sampled as described in section 4.1.1.

It is recommended that the first quarterly sample be used as a screening procedure for subsequent samples for the trace organics. The volatile and pesticide/PCB fractions of the EPA priority pollutant listing (Callahan et al., 1979) should be used to screen for volatile organic compounds and pesticides/PCBs, respectively. Subsequent quarterly samples should be analyzed for those organic contaminants detected in the screening sample.

4.1.4 Transformer Storage Area (Site 4)

Ground water monitoring wells: None initially

Type of samples: Soil

Number of samples: 5

Frequency: Once

Analytical parameters: PCBs

Remarks: Samples should be taken near the surface in areas of obvious spillage in the transformer storage area (see figure 4.1-1). At least one sample should be collected in the small drainage feature existing at the northeast corner of the site. One other sample should be collected along the fence surrounding the area.

If contamination is detected, a ground water monitoring well should be installed and sampled downgradient of the contaminated area on a quarterly basis for 1 year. The well should penetrate the water table aquifer (expected depth of approximately 20 feet) and should be screened over the entire saturated zone (and 2 to 3 feet above the water table), based on the seasonal high water table. Well construction, logging, and sampling procedures should be as described in section 4.1.1.

4.1.5 Pesticide Disposal Site (Site 5)

Ground water monitoring wells: None initially

Type of samples: Soil

Number of samples: Five

Frequency: Once

Analytical parameters: Pesticides

Remarks: A vertical core sample should be collected as close as possible to the pesticide disposal site (french drain, see figure 4.1-1), and discrete soil samples should be taken from the core at depths of 1, 2, 3, 4, and 5 feet. Each individual sample should be analyzed for EPA priority pollutant pesticides (Callahan *et al.*, 1979) to establish the vertical distribution of any contaminants present.

If contamination is detected in the soil samples, then a monitoring well should be installed and sampled on a quarterly basis for 1 year to determine if contaminants are present in the ground water. The well should penetrate the water table aquifer (expected depth of approximately 20 feet) and should be screened over the entire saturated zone (and 2 to 3 feet above the water table), based on the seasonal high water table. Well construction, logging, and sampling procedures should be as described in section 4.1.1.

4.1.6 CD Landfill (Site 6)

Ground water monitoring wells: None

Surface water/creek sampling points: 2 (see site 6 proposed sampling locations, figure 4.1-1)

Type of samples: Surface water/creek sediment

Number of samples: 16

Frequency: Quarterly for 1 year

Analytical parameter: Cadmium. It is recommended that only dissolved cadmium be analyzed for water samples and total cadmium be analyzed for sediment samples.

Remarks: One surface water/creek sediment sampling point should be established in each of the creeks to the north and south of the site where they are closest to the landfill. These creeks may intercept any contaminants potentially migrating from the landfill via the shallow ground water. A water and a sediment sample should be collected on a quarterly basis for at least 1 year at each sampling point. In addition, consideration should be given to long-term monitoring of this site due to the recent (1974 to 1981) nature of the burial of drummed cadmium-contaminated wastes.

4.2 OTHER RECOMMENDATIONS

It is recommended that the LANTNAVFACENGCOM Facilities Planning and Real Estate Department be advised of the locations of the 18 sites identified in this IAS and that all new construction at SPNC be coordinated through the LANTNAVFACENGCOM Facilities Planning and Real Estate Department and Environmental Quality Branch.

SECTION 5.0
BACKGROUND

5.1 GENERAL

5.1.1 Location and Organization

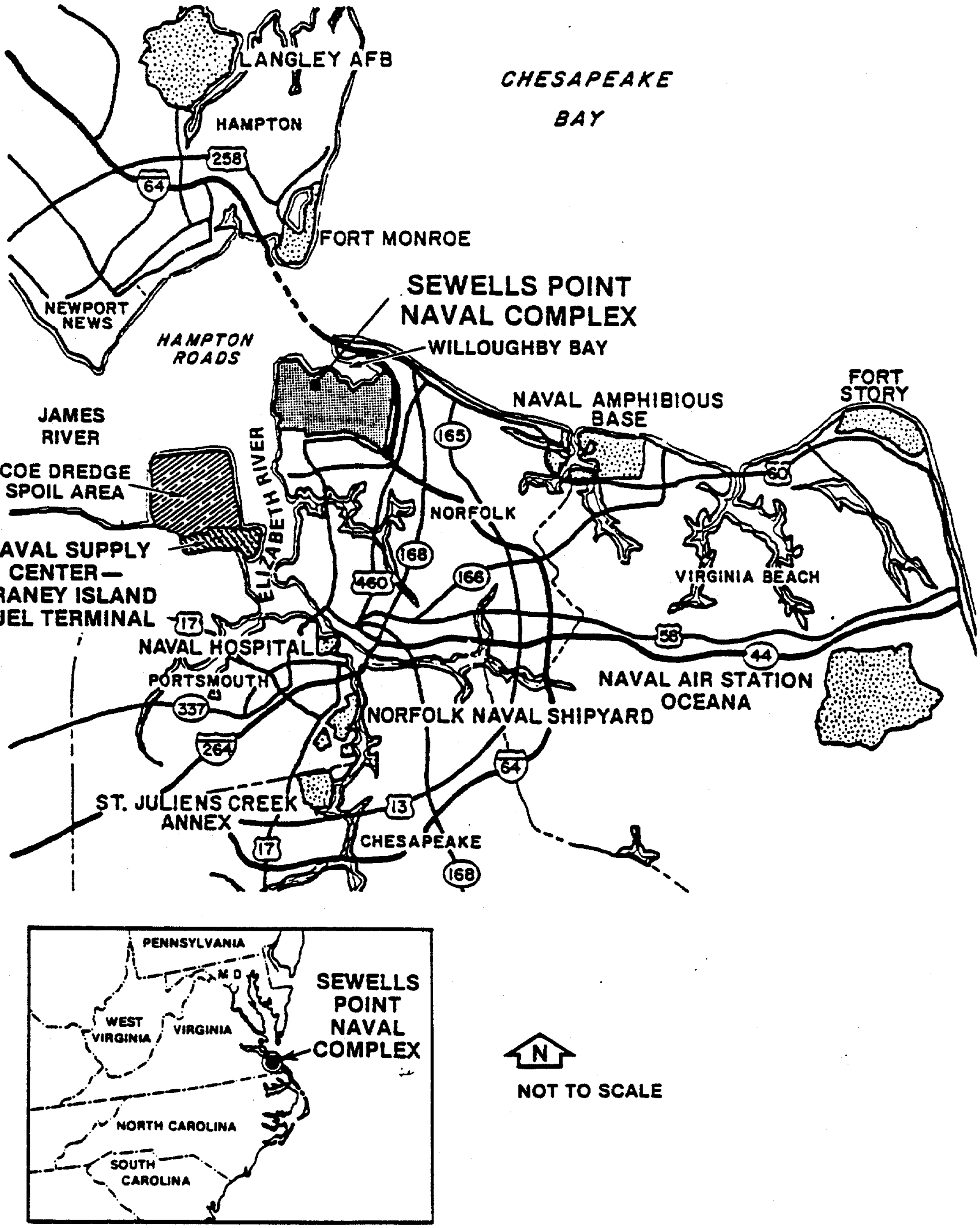
Sewells Point Naval Complex (SPNC) is located on 4,631 acres of land in the city of Norfolk, Va., at the extreme northwestern corner of the city of Norfolk (see figure 5.1-1). SPNC is bounded on the north by Willoughby Bay, on the west by the Elizabeth River at the point where it joins the James River to form Hampton Roads, and on the south and east by the city of Norfolk. A portion of the eastern boundary is formed by Mason Creek.

SPNC contains approximately 4,000 buildings and an all-weather airfield. The western portion of SPNC is a developed waterfront area containing railway lines and pier facilities for loading, unloading, and servicing naval vessels [Atlantic Division, Naval Facilities Engineering Command (LANTNAVFACENGCOM), n.d.].

SPNC is the principal operating base of the U.S. Atlantic Fleet and houses most major fleet command headquarters. Approximately 170 shore activities and fleet commands, including Marine Corps units and the North Atlantic Treaty Organization's (NATO) Supreme Allied Command, Atlantic (SACLANT), are located at SPNC. SPNC is the homeport for more naval vessels than any other Atlantic port, and is one of two Atlantic ports with the capability of loading aviation support equipment on board aircraft carriers at pierside [Commander, Naval Base Norfolk (COMNAVBASE NORFOLK), 1977; LANTNAVFACENGCOM, n.d.].

Eleven of the activities at SPNC maintain Class I plant account property on SPNC, and four of these activities serve as hosts for tenant commands (see appendix B). These activities and the locations of their property on SPNC are illustrated on figure 5.1-2.

Twenty-two activities at SPNC, including nine real property holders, were identified by COMNAVBASE NORFOLK and LANTNAVFACENGCOM personnel as those with the potential for handling, storing, or disposing of toxic/hazardous materials. A listing of these 22 activities, along with their host/tenant relationships, appears in



SOURCES: LANTNAVFACENGCOM, n.d.
ESE, 1982.

Figure 5.1-1
LOCATION MAP

INITIAL ASSESSMENT STUDY
SEWELLS POINT
NAVAL COMPLEX

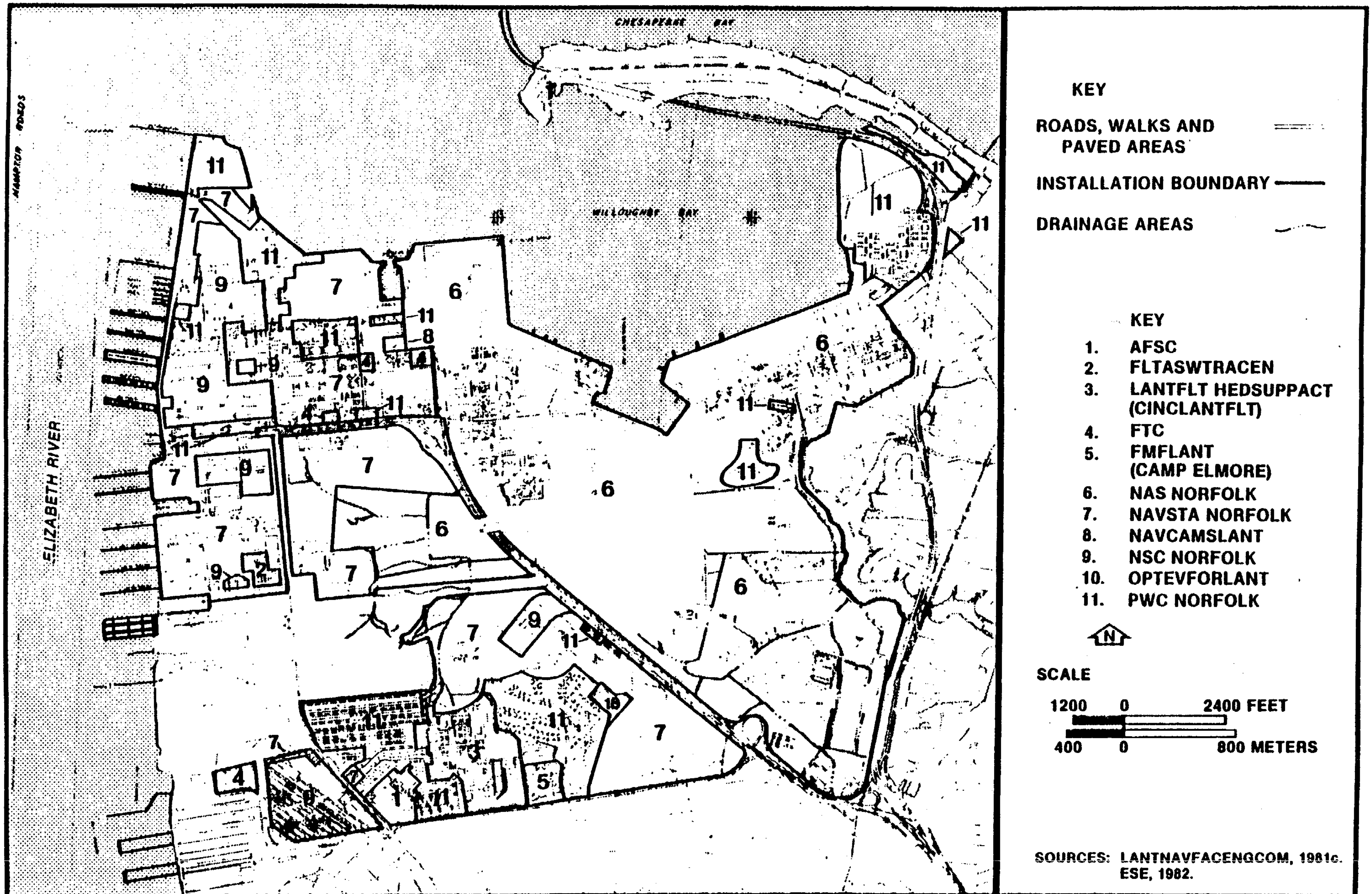


Figure 5.1-2
LAND OWNERSHIP

INITIAL ASSESSMENT STUDY
SEWELLS POINT
NAVAL COMPLEX

table 5.1-1. The missions of the five activities which generate the majority of toxic/hazardous materials at SPNC are as follows:

1. NAVSTA NORFOLK: NAVSTA NORFOLK provides, as appropriate, logistical support for the operating forces of the Navy and dependent activities in the following areas:

   a. Port facilities and services,

   b. Fire and police protection for SPNC,

   c. Recreation and morale program for SPNC,

   d. Operation of a correction center,

   e. Operation of a degaussing facility, and

   f. Operation of bachelor housing.

2. PWC NORFOLK: PWC NORFOLK provides public works, utilities, family housing, transportation support, engineering services, and shore facilities planning support. In addition, PWC NORFOLK provides all other logistic support of a public works nature required by the operating forces and dependent activities at SPNC.

3. NAS NORFOLK: NAS NORFOLK is responsible for operating and maintaining facilities and providing services and material to support operations of aviation activities and units of the operating forces. In addition, NAS NORFOLK:

   a. Acts as a transshipment point for classified ordnance,

   b. Operates bachelor housing,

   c. Operates open mess facilities for all officers and enlisted personnel in SPNC, and

   d. Operates consolidated package stores for SPNC.

4. NAVAIREWORKFAC NORFOLK: A tenant of NAS NORFOLK, under the command of the Naval Air Systems Command (NAVAIRSYSCOM), NAVAIREWORKFAC NORFOLK is responsible for depot-level rework operations on aircraft, engines, avionics, ground support equipment (GSE), and missile guidance systems. In addition, NAVAIREWORKFAC NORFOLK provides engineering, technical, and professional services in support of rework operations.

5. NSC NORFOLK: NSC NORFOLK, under the command of the Chief of Naval Material (CNM), provides supply and support services to fleet units and shore activities in the area of

Table 5.1-1
Activities at SPNC Examined for the IAS

Activity	Short Title	Property Holder/Tenant Status
Naval Station*	NAVSTA NORFOLK	Property Holder
Navy Public Works Center*	PWC NORFOLK	Property Holder
Defense Property Disposal Office	DPDO	Tenant-Naval Supply Center
Fleet Marine Force, Atlantic (Camp Elmore)	FMFLANT	Property Holder
Naval Air Station*	NAS NORFOLK	Property Holder
Naval Air Rework Facility*	NAVAIREWORKFAC NORFOLK	Tenant-Naval Air Station
Naval Supply Center*	NSC NORFOLK	Property Holder
Naval Safety Center	NAVSAFECEN	Tenant-Naval Air Station
Armed Forces Staff College	AFSC	Property Holder
Naval Publications and Printing Service Office	NPPSO	Tenant-Naval Air Station
Fleet Training Center	FTC	Property Holder
Construction Battalion Unit 411	CBU-411	Tenant-Naval Air Station
Operational Test and Evaluation Force	OPTEVFORLANT	Property Holder
Navy Regional Medical Center	NRMC	Tenant-Naval Station
Shore Intermediate Maintenance Activity (Norfolk)*	SIMA NORFOLK	Tenant-Naval Station
Shore Intermediate Maintenance Activity, Portsmouth*	SIMA PORTSMOUTH	Tenant-Naval Air Station
Navy Regional Dental Center	NRDC	Tenant-Naval Station
U.S. Atlantic Fleet Headquarters Support Activity (Commander in Chief, U.S. Atlantic Fleet)	LANTFLT HEDSUPPACT (CINCLANTFLT)	Property Holder
Naval Environmental Preventive Medicine Unit No. 2	NAVENPVNTMEDU TWO	Tenant-Naval Station
Fleet Aviation Specialized Operational Training Group, Atlantic	FASOTRAGRULANT	Tenant-Naval Air Station
Mobile Technical Unit 2	MOTU-2	Tenant-Naval Station
Nuclear Weapons Training Group, Atlantic	NUWPNTRAGRULANT	Tenant-Naval Station

* Principal activities with regard to major waste generation.

Source: ESE, 1982.

responsibility and overseas activities in the Atlantic and Mediterranean area. In addition, NSC NORFOLK provides:

a. Supply support of inert classified ordnance materials to Navy and Marine Corps units in the eastern Continental United States (CONUS) and Atlantic Fleet areas of operation;

b. Joint personal property shipping services for all authorized military and civilian personnel in the Tidewater, Va. area;

c. A Department of Defense (DoD) common-user ocean terminal;

d. The Norfolk Air Terminal for all DoD cargo, mail, and passengers; and

e. Three offpost facilities, which function as follows: (1) Craney Island Fuel Terminal (NSC-CI), which is located across the Elizabeth River in Portsmouth, Va., serves as the primary fuel facility for NSC NORFOLK and as such is the largest military fuel facility in the world, with a capacity in excess of 2.8 million barrels (BBL); (2) Yorktown fuel farm, which is located on the York River, contains a fueling pier and 26 underground tanks and has a capacity of 1.4 million BBL; and (3) Cheatham Annex, which is located 10 miles north of Yorktown, operates as a cold storage plant supplying food to the U.S. Army in Europe (NSC NORFOLK, 1969).

All of the activities listed in table 5.1-1 report for area coordination to COMNAVBASE NORFOLK, which is housed at SPNC and is responsible for coordinating the defense of the seacoast and shipping in the Tidewater Region of Virginia (within a 50-mile radius of Norfolk). Only two of the activities, NAVSTA NORFOLK and NAS NORFOLK, are under the command of COMNAVBASE NORFOLK (COMNAVBASE NORFOLK, 1977).

5.1.2 Host/Tenant Relationships

No comprehensive listing was found for tenant activities on SPNC; however, examination of existing data indicates that only 4 of the landholders on SPNC support tenant activities and that these tenants total at least 160. Appendix B contains tenant listings compiled for NAVSTA NORFOLK, NAS NORFOLK, NSC NORFOLK, and LANTFLT HEDSUPPACT (CINCLANTFLT). Table 5.1-1 identifies those tenants involved in the handling of hazardous materials and wastes and their host activities. Activities conducted by these tenants are discussed in section 6.0, Activity Findings.

5.1.3 Leases and Agreements

The Navy has acquired 72 ingrants (leases, easements, permits, and agreements) totalling 202.85 acres for use of property outside the boundaries of SPNC. The majority of these involve rights-of-way for utility lines and transportation accesses and are not of interest from the standpoint of toxic/hazardous materials. Three, however, are of potential interest: two with the State of North Carolina for disposition of dredged material and use of a dredged material disposal area adjacent to the NAS NORFOLK Harvey Point offbase testing site in North Carolina, and one with the Army for use of an ordnance detonation range. Specific information regarding these real estate negotiations is available from the LANTNAVFACENGCOM Facilities Planning and Real Estate Development.

The Navy, in turn, has provided 74 real estate outgrants (leases, easements, permits, licenses, and agreements) for 277.69 acres on SPNC to local government, commercial, and private interests. The outgrants are primarily for housing and office space, access roads, and rights-of-way for utility lines (LANTNAVFACENGCOM, 1981b) and, consequently, are of no further interest in the context of this report.

Prior to 1975, the Navy held a variety of inleases from commercial establishments outside gate 2, south of the intersection of Admiral Taussig and Hampton Blvds. These are no longer in effect, since the Navy subsequently acquired the property as part of SPNC. In addition, the records search yielded information concerning lease agreements from the World War II era which involved the use of three fields on private farms for NAS NORFOLK training, bombing, and gunnery exercises (Navy Bureau of Aeronautics, 1940).

5.1.4 Legal Claims

A number of claims have been made against activities on SPNC relating to hazardous materials and wastes. These have been restricted to claims for property damage resulting from air emissions and are itemized below (Personal Communication, 1982; The Ledger-Star, 1981).

1. Each year approximately four to five claims are made against PWC NORFOLK for damage to cars parked in the vicinity of the power plant (Bldg. P-1). Reportedly, this plant currently burns high sulfur fuel oil (2.5 percent) and emits sulfur fumes (sulfur dioxide and sulfur trioxide) and heavy particulates (vanadium pentoxide), which land on parked automobiles. In the past, high sulfur coal was used for fuel. Moisture combining with the sulfur results in the formation of sulfuric acid, which reportedly causes corrosion of the painted surface on the cars. Nevertheless, at the present time, the plant is reportedly in compliance with State emissions standards.

Further complaints against Bldg. P-1 have been made by private citizens along Willoughby Spit and users of the Navy Marina north of SPNC near the heliport, who claimed emissions from the plant sooted their boats. The State monitored emissions during that time (1980) and determined that other non-Navy operations in the area were contributing to the problem.

2. On 12 Aug 1981, a chemical fire occurred in cell 6 of Bldg. SDA-215, an NSC NORFOLK waste storage area. The fire was reportedly caused by incompatible chemical storage (see section 6.3.2.3). The Navy received claims for damage to automobiles parked near the scene of the fire.

3. Between September and October 1981, a number of automobiles parked near Bldg. V-28 were reportedly damaged by deposition of air pollutants from NAVAIREWORKFAC NORFOLK paint stripping operations.

4. Bldg. LP-20 also has been the object of complaints concerning damage to motor vehicles. Reportedly, the damage is caused by deposition of air pollutants from NAVAIREWORKFAC NORFOLK stripping, plating, and degreasing operations. In addition, air pollutants which damage vinyl tops, blacken buildings, and damage clothing are reportedly emitted from the jet engine test cells adjacent to Bldg. LP-20.

5.1.5 Adjacent Land Use

SPNC is located at the hub of the Tidewater Region of Virginia, a diverse land use area stretching from Mathews and Northampton Counties in the north to the North Carolina border in the south and from Virginia Beach in the east to Southampton, Surry, James City, and Gloucester Counties in the west. SPNC is bounded on the north by Willoughby Bay and the west by the Elizabeth River at Hampton Roads. The coastal land area to the south of the SPNC pier area is predominantly industrial. This waterfront area provides shipping facilities for several commercial industrial operations, including Continental Grain Co., Universal Atlas Cement Division of the U.S. Steel Corp., and Exxon Co., U.S.A., and is interlaced by railroad lines. Inshore from these waterfront areas, the land becomes low-density residential, with Hampton Blvd. serving as a divider. A buffer area of open spaces and/or tree growth adjacent to the southern boundary along International Terminal Blvd. and the eastern boundary along Interstate 64 separates SPNC from surrounding residential areas. Northeast of SPNC is the Willoughby Spit, a low-density residential area used extensively throughout the summer for recreational activities.

A high concentration of military installations occurs within a 25-mile radius of SPNC. To the north across Hampton Roads are Langley Air Force Base and Fort Monroe; to the east are the Little Creek Naval Amphibious Base and Fort Story; to the southeast is the Naval Air

Station, Oceana (NAS OCEANA); to the south are Norfolk Naval Shipyard (NORFOLKNAVSHIPYD) and St. Juliens Creek Annex; and to the west and southwest across the Elizabeth River is the NSC NORFOLK oil storage facility at Craney Island and a U.S. Coast Guard Support Center (LANTNAVFACENGCOM, n.d.; COMNAVBASE NORFOLK, 1977; LANTNAVFACENGCOM, 1976a).

5.2 HISTORICAL OVERVIEW

By virtue of a Presidential Proclamation dated 28 Jun 1917, the U.S. Navy took possession of 474 acres of land at SPNC, thus establishing a presence in the area which has continued and expanded since that time. The original acquisition included a number of buildings constructed as part of a 1907 Exposition celebrating the 300th anniversary of the English settlers landing at Jamestown, Va. The proclamation was a direct result of war having been declared against Germany.

Construction of facilities required to house and train naval personnel at the site began on 4 Jul 1917. Within 30 days, barracks, mess halls, storehouses, and water, light, and road systems sufficient to accommodate 7,500 persons had been constructed and were in use. Several of the buildings erected for the 1907 Exposition were left standing and later converted for Navy use. In 1975, the 19 buildings on base remaining from the 1907 Jamestown Exposition were placed on the Virginia Landmarks Register and subsequently on the National Register of Historic Places. These buildings are shown in appendix C.

On 12 Oct 1917, the naval facilities at SPNC were officially commissioned as the Hampton Roads Naval Operating Base (NOB). It soon became apparent that the available land area would have to be expanded and extensive pier facilities added if the base were to fulfill its mission. Thus, during the autumn of 1917 and the unusually severe winter of 1918, bulkheads were built in the waters off the west and north side of SPNC. The subsequent dredge and fill operation extended the usable land area out to the bulkheads, increasing the total area under Navy control from 474 to 792 acres.

On 27 Aug 1918, 143 acres of land in the northeast corner of the NOB was officially commissioned for use as an air station. Originally, seven sea planes and a number of rigid and nonrigid lighter-than-air craft (LTA) operated from hangars in this area. These craft performed wartime patrols along the Atlantic Coast, with LTA operations continuing until the unit was decommissioned in 1924. This activity was later to evolve into the current NAS NORFOLK and also represents the origin of NAVAIREWORKFAC NORFOLK, which was elevated to command level in 1967.

Another of the major commands currently operating at SPNC originated during this early period when on 1 Mar 1919, the Naval Supply Station, later to become Naval Supply Center, was officially commissioned. This unit performed its original function of providing supplies to the fleet out of a group of warehouses built as part of initial site development efforts in 1917.

The decreased scope of naval operations that followed World War I and the subsequent economic depression combined to inhibit any large-scale post-war changes in the SPNC facilities. Historical maps show that only minor construction was completed between 1920 and 1935. Although administrative and command structure changes were made, growth remained slow at SPNC until the late 1930s.

By 1936, expansion of materials handling facilities and improvement of pier equipment were undertaken by the Naval Supply Station, which was then known as the Naval Supply Depot. The Air Station began expanding eastward by acquiring and filling areas of the Mason Creek basin and Willoughby Bay to make room for hangar facilities and runways. By 1940, with United States involvement in World War II imminent, the Supply Depot was engaged in a major expansion. The Air Station had increased its available land area from the original 143 acres to 238 acres, a figure which was to reach 2,150 by 1942 through an ambitious program of acquisition and dredge and fill operations.

During World War II, SPNC functioned as one of the major operations, training, and supply bases for the United States Atlantic Fleet. Between 1940 and 1945, major construction projects completed included seven piers, numerous runways and hangars, a hospital, a power plant, two warehouse complexes, a tank farm, and several barracks/housing complexes. Land acquired during this period totalled over 2,100 acres.

With the end of World War II, the level of naval operations diminished sharply. Many ships were decommissioned and crews were discharged. Naval bases were established at a number of major wartime operating locations under the guidelines set forth in General Order 233 issued 14 Sep 1945 for the purpose of providing a framework for administrative reorganization necessary to put the Navy on a peacetime footing. Thus, Naval Base, Norfolk (NAVBASE NORFOLK) was established, comprising the major components of the former NOB at SPNC and a number of other facilities in and around Hampton Roads. The NOB was later to be reorganized to become NAVSTA NORFOLK.

During 1947 and 1948, several administrative orders were issued relative to organization and responsibilities of the various activities at SPNC, which officially commissioned two of the current major activities. On 2 Jan 1948, all supply operations, including those formerly performed by the Air Station, were consolidated under NSC NORFOLK. On 15 Jun 1948, all public works functions were consolidated under PWC NORFOLK.

Although far removed from the war zone, NSC NORFOLK in particular and SPNC in general saw an increase in equipment maintenance and support activities during the era of the Korean Conflict (1948 to 1954). Numerous ships and items of equipment which were deactivated in 1946 were reactivated, resupplied, and sent back to sea during this period. A similar increase in activity reportedly occurred during the Vietnam Conflict.

In the years since 1950, SPNC has continued to expand physically through various types of land transfers and the continuation of fill operations. The total land area is now 4,631 acres, and the base extends noticeably farther northeast into Willoughby Bay and the Mason and Bousch Creek areas.

Many of the changes which have taken place at SPNC since 1960 have been necessitated by the evolution of naval hardware. Aircraft carriers equipped with sophisticated jet fighters, guided-missile cruisers, and helicopters for attack and support have become primary tools of naval operations. For this reason, much of the construction, rehabilitation, and retooling which has taken place at SPNC in the past 20 years has been aimed at providing the necessary support and maintenance capabilities for these types of equipment. Waterfront construction includes the addition of piers 12, 20, 24, and 25, as well as finger piers in the small boat basin. NAVAIREWORKFAC NORFOLK added the avionics shop and an industrial waste treatment plant (IWTP) in the 1970s and currently has a new plating shop planned. Extensive alterations have been made to World War II era hangars, taxiways, runways, and air traffic control facilities.

The history of SPNC has been one of almost continuous expansion, while the overall mission of providing maintenance, supplies, operations support, and training to Atlantic Fleet ships and their crews has remained relatively unchanged. The major activities examined in this study (NAVAIREWORKFAC NORFOLK, PWC NORFOLK, NAS NORFOLK, NAVSTA NORFOLK, AND NSC NORFOLK) have undergone many changes in name and organization, but the functions they perform have been part of SPNC since 1917 (LANTNAVFACENGCOM, n.d.; COMNAVBASE NORFOLK, 1952; NSC NORFOLK, 1969).

5.3 PHYSICAL FEATURES

5.3.1 Climatology

The Norfolk area is characterized by a maritime climate, with long temperate summers and mild winters. The average annual temperature is 60.7 degrees Fahrenheit. July is the warmest month, with temperatures averaging 78.7 degrees Fahrenheit; January is the coolest month, with temperatures averaging 43.1 degrees Fahrenheit. Temperatures fall below freezing only a few days per year.

The average annual precipitation is 43 inches and is well distributed throughout the year. A slight precipitation maximum occurs during the months of June, July, and August due to the prevalence of convective thunderstorms. The average annual snowfall is 8.8 inches, with an average of 5 inches of snow falling in January and February [U.S. Soil Conservation Service (USSCS), 1959]. Winds are generally moderate and easterly, and average annual evaporation is approximately 40 inches.

5.3.2 Topography

SPNC occupies the major portion of a broad low-lying peninsula, which trends northwestward into Hampton Roads (see figure 5.1-1). This peninsula is part of the Virginia outer coastal plain, an area characterized primarily by broad, gently eastward-sloping plains separated by eastward-facing scarps. Drainage in the area surrounding Hampton Roads is generally sluggish, and most of the streams are tidal. Elevations range from mean sea level (MSL) to about 25 feet above MSL.

Much of what is now SPNC was once tidal marsh which has been filled with dredged spoil (see figure 5.3-1). One tidal creek, Boush Creek, has been completely eliminated, and Mason Creek has been extensively modified by past fill operations. Maximum elevations at SPNC are less than 25 feet above MSL.

5.3.3 Geology

SPNC is underlain by gently dipping, sandy sediments to a depth of over 2,000 feet. These sediments range in age from Recent to Lower Cretaceous (see figure 5.3-2). Underlying the sediments are igneous and metamorphic rocks characteristic of the Appalachian Piedmont. The Sand Bridge Formation of Pleistocene age crops out over much of SPNC, and the remainder of the surficial sediments consists of fill (Barker and Bjorken, 1978) (see figure 5.3-1). The Sand Bridge is generally underlain by the Norfolk Formation, also of Pleistocene age. However, the Norfolk Formation is absent in some areas of SPNC, as shown in figure 5.3-1. These two formations, as well as the fill at SPNC, have a combined thickness of about 60 feet. The top layer of these two formations consists of unconsolidated fine sands and silts, whereas the bottom 20 to 40 feet consists of relatively impermeable sediments, including silt, clay, and sandy clay. The Norfolk and Sand Bridge Formations are underlain by the Yorktown Formation of Pliocene and/or Miocene age, which consists of moderately consolidated glauconitic sand, clay, and shell beds (Siudyla *et al.*, 1981).

5.3.3.1 Ground Water

To some extent, all of the formations in the shallow subsurface function as aquifers; however, the Sand Bridge and Norfolk Formations comprise the water table aquifer. This aquifer is thin, and the water-bearing strata are discontinuous. Depth to ground water is generally less than 8 feet. Well yields from this unconfined aquifer are generally low but adequate for domestic and small industrial use. This aquifer is used extensively for lawn watering in nearby residential areas.

Flow in the shallow ground water system is slow due to the level topography and the low to moderate permeability of the sediments.

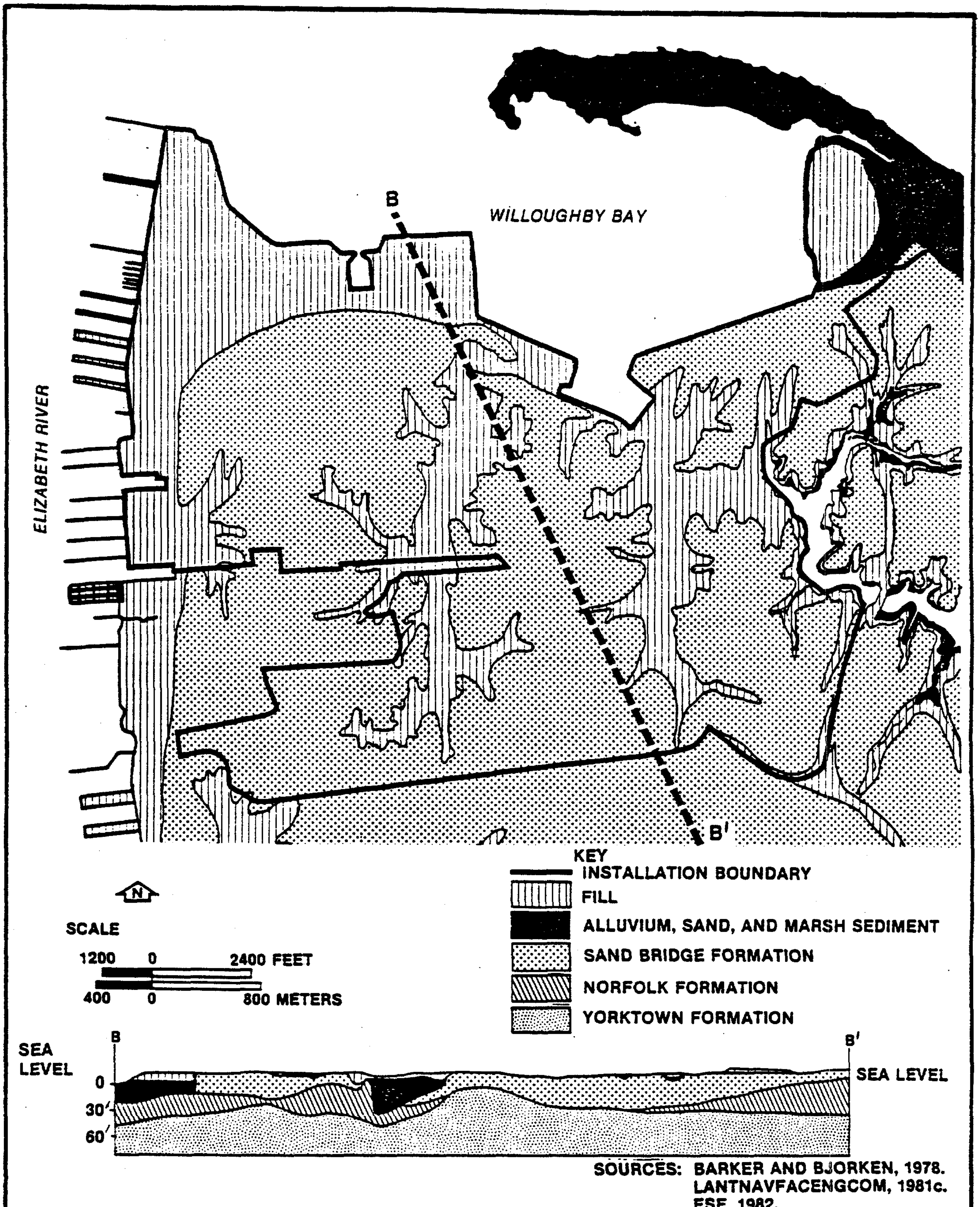


Figure 5.3-1
GEOLOGIC MAP AND CROSS SECTION

INITIAL ASSESSMENT STUDY
SEWELLS POINT
NAVAL COMPLEX

SYSTEM	STRATIGRAPHIC UNITS		HYDROGEOLOGIC UNITS	DESCRIPTION OF HYDROGEOLOGIC UNITS
		[illegible] AND RECENT	WATER TABLE OR QUATERNARY AQUIFER	UNCONSOLIDATED SAND, SILT, AND SOME GRAVEL; SAND UNITS YIELD QUANTITIES ADEQUATE FOR DOMESTIC AND SMALL INDUSTRIAL DEMANDS; USED EXTENSIVELY FOR LAWN WATERING; UNCONFINED AQUIFER
QUATERNARY	COLUMBIA GROUP	SAND BRIDGE NORFOLK		
TERTIARY	CHESAPEAKE GROUP	YORKTOWN	YORKTOWN AQUIFER	SAND AND SHELL BEDS MAIN WATER-BEARING UNITS; ADEQUATE FOR MODERN PUBLIC AND INDUSTRIAL SUPPLIES; ARTESIAN AQUIFER
		CALVERT	CONFINING UNITS	SILT AND CLAY PREDOMINANT; MINOR SAND LENSES
	NANJEMOY		NOT FOUND IN STUDY AREA	
TERTIARY / CRETACEOUS	MATTAPONI		EOCENE-UPPER CRETACEOUS AQUIFER	GLAUCONITIC SAND AND INTER-BEDDED CLAY AND SILT; INFRE-QUENTLY USED AS A WATER SUPPLY; YIELDS ADEQUATE FOR MODERATE SUPPLIES; BRACKISH IN MOST OF AREA; ARTESIAN AQUIFER
CRETACEOUS	LOWER CRETACEOUS	TRANSITIONAL BEDS PATUXENT	LOWER CRETACEOUS	INTERBEDDED GRAVEL, SAND, SILT, AND CLAY; YIELDS ARE ADEQUATE FOR LARGE INDUSTRIAL USE; BRACK-ISH IN MOST OF AREA: ARTESIAN AQUIFER

SOURCES: SIUDYLA ET AL., 1981.
ESE, 1982.

Figure 5.3-2
STRATIGRAPHIC AND HYDROGEOLOGIC UNITS OF SOUTHEASTERN VIRGINIA

INITIAL ASSESSMENT STUDY
SEWELLS POINT
NAVAL COMPLEX

The Elizabeth River and Willoughby Bay, which are the western and northern site boundaries, respectively, also form the shallow aquifer system boundaries. In addition, Mason Creek, which forms part of the eastern site boundary, also receives shallow ground water inflow. The downstream reach of Mason Creek traverses SPNC in an underground culvert and discharges to Willoughby Bay. Consequently, all shallow ground water onsite eventually discharges to the Elizabeth River or Willoughby Bay.

The Yorktown Formation, which functions as a confined aquifer in the area, is generally separated from the overlying water table aquifer by 20 to 40 feet of silt, clay, and sandy clay. These relatively impermeable sediments occur at the bottom of the formations (Sand Bridge or Norfolk Formation) which overlie the Yorktown Formation. However, in some areas, the confining beds of silt, clay, and sandy clay are absent, and recharge of the Yorktown Aquifer may be occurring in these areas. This condition apparently exists in the Camp Allen area, which is the southwestern portion of SPNC, as a result of a former channel of Boush Creek that cuts through the confining beds. Soil borings at the Navy Brig (Bldg. CA-482) located in the Camp Allen area indicate the presence of only sand to a depth of 81 feet (LANTNAVFACENGCOM, 1970a and 1970b). Boush Creek no longer exists, since it was filled in during past construction.

Although the Yorktown Formation is several hundred feet thick, the principal water-bearing beds comprising the Yorktown Aquifer are located in the upper 50 to 100 feet of the formation. The top of the Yorktown Formation is generally about 60 feet below the ground surface. Well yields for 6-inch and larger wells in the Yorktown Aquifer average approximately 90 gallons per minute. This aquifer is used in the area near SPNC for industrial process water supply (see section 5.3.3.2, Wells, for more detail). The Yorktown Aquifer is underlain by several hundred feet of silt and clay. The Upper and Lower Cretaceous Aquifers lie below the silt and clay (Siudyla _et al._, 1981).

5.3.3.2 Wells

Four water supply wells are located at SPNC (see figure 5.3-3). Wells A, B, C, and D are used for lawn watering and vehicle washing and are not intended for potable water supply. However, the potential exists for individuals from the surrounding residential areas to drink water from these wells. Well A is 110 feet deep, well B is 90 feet deep, and well C is 85 feet deep. These wells were constructed in April 1981. It is not possible to determine what portions of the wells are screened, since no construction details were available, but they reportedly draw water mainly from the shallow aquifer. No information was available regarding the depth or date of construction for well D.

As shown in figure 5.3-3, two wells (wells E and F) are located just west of SPNC. These wells provide 90,000 to 100,000 gallons per day of nonpotable process water for the Sheller-Globe plant, which manufactures cork gaskets (Siudyla _et al._, 1981). These wells are

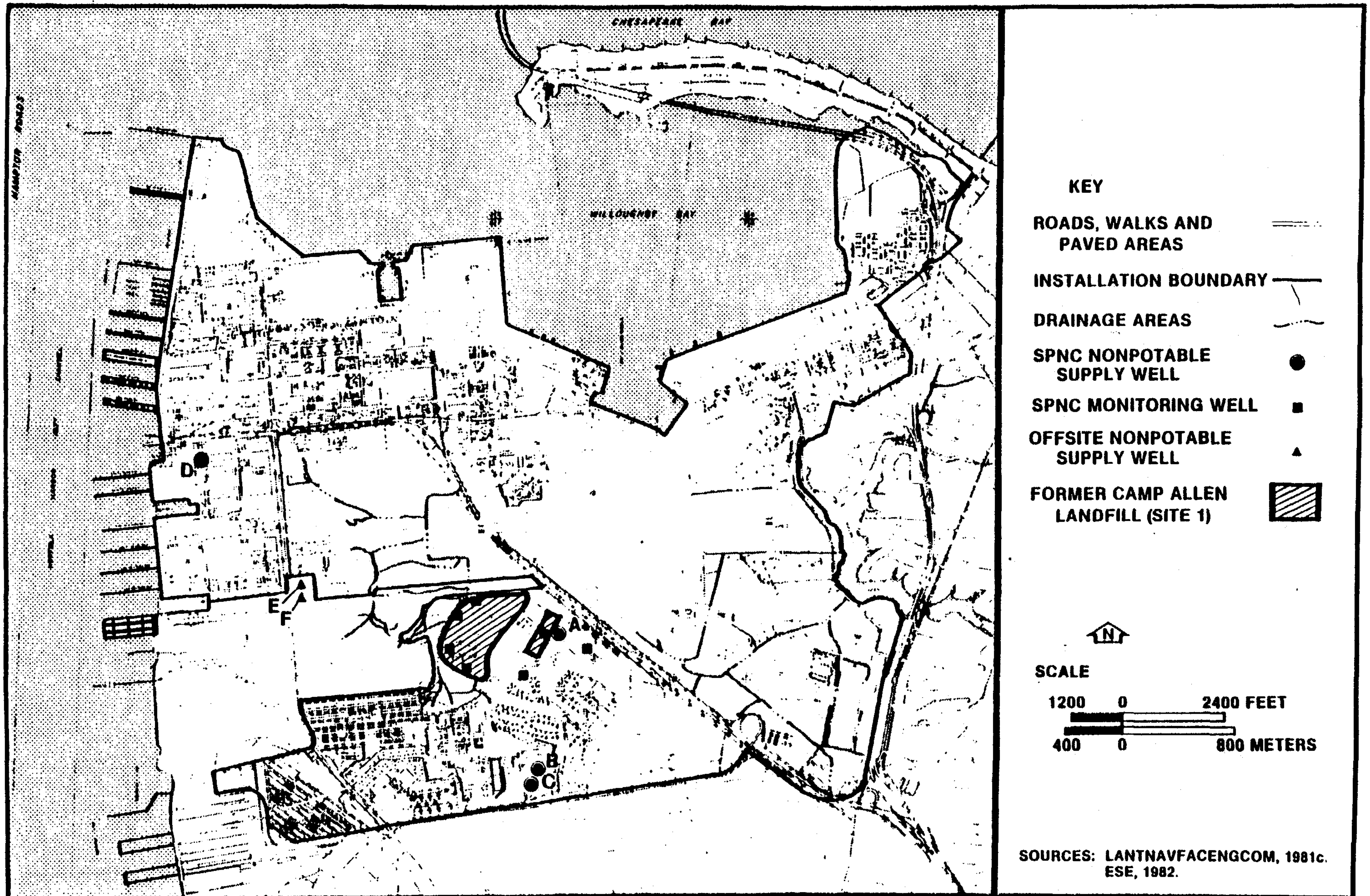


Figure 5.3-3
WELL LOCATIONS

INITIAL ASSESSMENT STUDY
SEWELLS POINT
NAVAL COMPLEX

125 feet deep and are screened over the interval of 100 to 120 feet deep to draw water mainly from the Yorktown Aquifer.

There are also seven monitoring wells located in and around the former Camp Allen landfill (site 1) of SPNC (see figure 5.3-3). These wells have been used to collect ground water samples periodically since 1974. No construction details were available for these wells, which are discussed further in section 6.5.

5.3.4 Surface Water Hydrology

SPNC is drained by Mason Creek and the remnants of Boush Creek, the main channel of which was completely filled and replaced by a network of drainage ditches during development of SPNC. Stormwater runoff from the highly developed portion of the installation is collected by a network of inlets to underground culverts, which convey the water either to Mason Creek or directly to Willoughby Bay or the Elizabeth River. Due to the proximity of these tidal surface waters and the low relief of the land surface, both Mason Creek and the remnant tributaries of Boush Creek are tidal throughout SPNC.

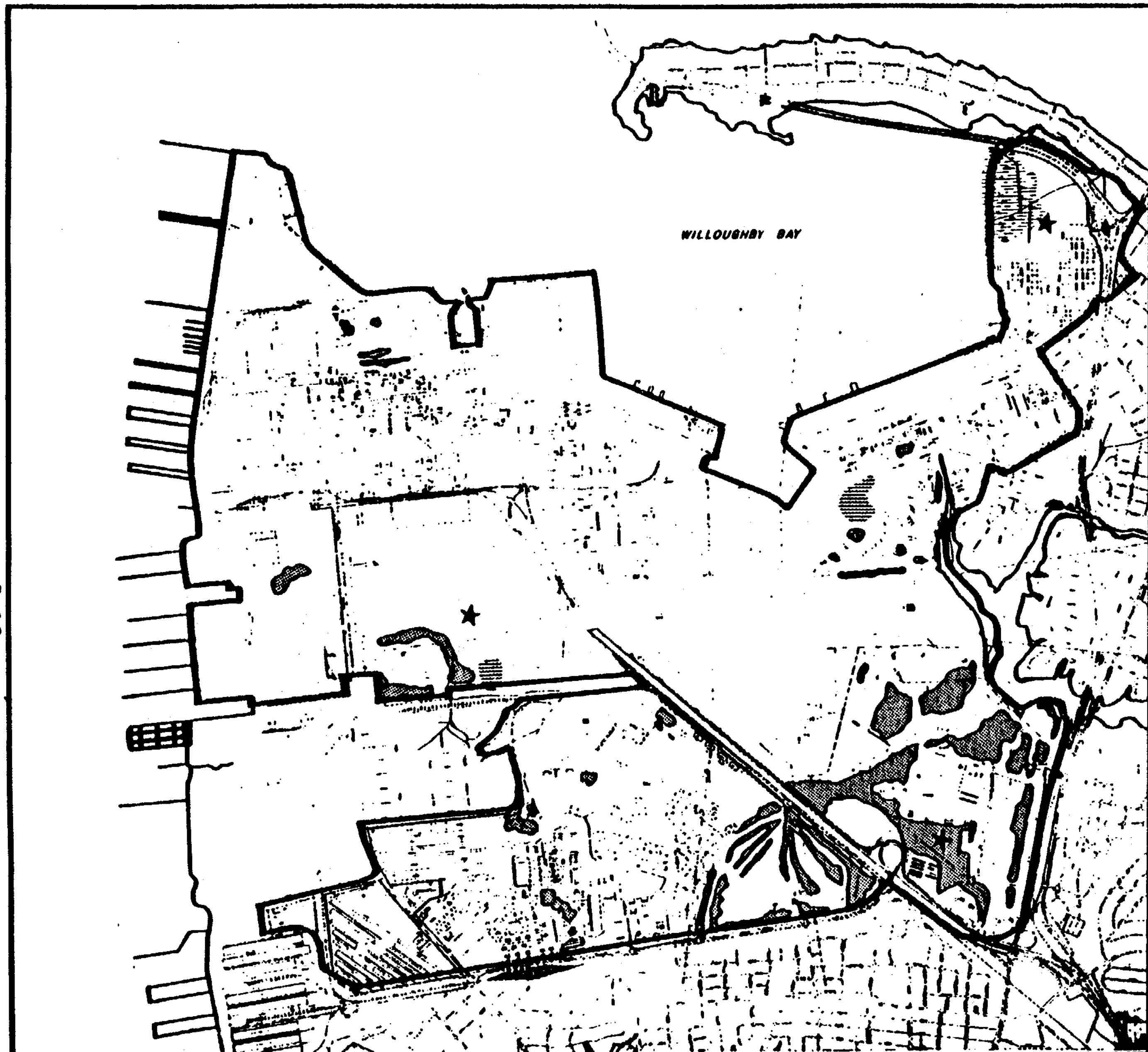
5.4 BIOLOGICAL FEATURES

The habitat which originally covered the SPNC area has been disturbed by development, and the majority of the coastline has been altered by dredge and fill practices and the construction of seawalls and docking facilities. Industrial and maintenance facilities, storage and refurbishing yards, drydocks, piers, and administrative and housing areas cover most of SPNC. Due to the high degree of development, the potential for woodland and wildlife resource management is low, and no extensive forest and wildlife management plans are available for SPNC.

5.4.1 Terrestrial Ecosystems

Terrestrial ecosystems on SPNC include ruderal areas (defined as disturbed areas covered by weeds and other plant species characteristic of early successional stages), such as old landfill sites and spoil disposal areas, woodlands, and improved and semi-improved grounds. These undeveloped areas are interspersed throughout SPNC and are limited to small areas. Ruderal areas are primarily located in the south and southeastern portions of SPNC and include sections of the naval magazine (NM) area and along portions of Mason Creek, as well as portions of the former Camp Allen landfill site (site 1). Mature hardwoods and pines are scattered throughout the southeastern section of SPNC, particularly in the NM area and the SPNC golf course area. Figure 5.4-1 shows the locations of some of the wooded areas and other habitats on SPNC.

Onsite terrestrial fauna are limited. Mammalian life includes rabbits, rodents, stray dogs, and stray cats. Small passerine birds are found onsite, and cormorants, gulls, and terns hunt the waters along the shore. Although the site lies along the Atlantic Flyway, an important migration route (especially for waterfowl), the proximity of the Great



KEY

INSTALLATION BOUNDARY

WOODED AREA

TIDAL MARSH

SMALL ANIMAL HABITAT

SURFACE WATER
(Collection During Rainstorm)

N

SCALE

1200 0 2400 FEET

400 0 800 METERS

SOURCES: LANTNAVFACENGCOM, n.d.
ESE, 1982.

Figure 5.4-1
NATURAL HABITAT AND VEGETATION

INITIAL ASSESSMENT STUDY
SEWELLS POINT
NAVAL COMPLEX

Dismal Swamp to the southwest and Chesapeake Bay to the northeast limits SPNC's importance to waterfowl. Flocks of mourning doves (Zenaidura carolinensis) have been reported to use SPNC during fall migrations.

5.4.2 Aquatic Ecosystems

Much of the aquatic environment on SPNC has been eliminated by fill operations. The largest aquatic area within SPNC proper is Mason Creek, although it has been extensively modified by fill operations. Table 5.4-1 lists some of the waterfowl common to the less developed regions of the SPNC area. The absence of wetlands on SPNC and the removal of offshore vegetation through dredging and seawall developments have reduced the numbers of these waterfowl occurring onsite.

Aquatic ecosystems of significance in the SPNC region are located offshore in Willoughby Bay, Hampton Roads, and the Elizabeth River. Intensive development and shipping practices associated with SPNC have severely altered the coastal areas of SPNC. Rooted vegetation has been largely eliminated by the construction of the seawalls, docking facilities, and dredging, not only at SPNC, but also in surrounding areas because of similar development and heavy shipping traffic. Consequently, estuarine phytoplankton have increased in importance as the primary source of productivity. Diatoms and dinoflagellates dominate the offshore aquatic environment. Diatoms that are dominant in the area include Skeletonema costatum, Thalassionema nitzschiodes, Nitzchia sp., Coscinodiscus sp., Asterionella sp., and Rhizosplenia sp. The colonial diatom Skeletonema costatum was the most abundant form present in samples taken from the Norfolk Harbor Channel area of the Elizabeth River (LANTNAVFACENGCOM, 1976a).

Blooms of red and brown nuisance dinoflagellates occur sporadically in the spring and summer. Copepods, including Acartia tonsa, Acartia clausi, and Pseudodiaptomus coronatus, are the dominant zooplankton species. Oyster and blue crab larvae also play an important part in the food web.

The fish fauna of the Elizabeth River area are diverse and include migratory as well as resident species. The lack of rooted marsh vegetation probably limits the use of nearshore areas of SPNC as breeding grounds, but the channel area with its high benthic productivity is an important feeding ground. Hampton Roads and the Elizabeth River are used as migratory routes by many species of fish that go farther upstream into the Elizabeth River and associated tributaries to spawn. Important commercial and recreational species of fish are present all year round in the waters surrounding SPNC. Table 5.4-2 lists some of the commercially important fish species, while table 5.4-3 is a tabulation of some of the benthic organisms common to SPNC offshore areas.

Invertebrates and mollusks of commercial importance occurring in the Elizabeth River, Hampton Roads, and Willoughby Bay include blue

Table 5.4-1
Partial Listing of Waterfowl Common to the SPNC Area

Common Name	Scientific Name
Snowy egret	*Leucophoyx thula*
Tricolored heron	*Hydranassa tricolor*
Double-crested cormorant	*Phalacrocorux auritus*
Herring gull	*Larus argentatus*
Laughing gull	*L. atricilla*
Common tern	*Sterna hirundo*
Osprey	*Pandion harioptus carolinensis*

Source: Navy Environmental Support Office (NESO), 1975.

Table 5.4-2
Commercially Important Fish Species Common to the SPNC Area

Common Name	Scientific Name
Croaker	*Micropogon undulatus*
Spot	*Leiostomus xanthurus*
Bluefish	*Pomatomus saltatrix*
Rockfish	*Roccus saxatilis*
Speckled trout	*Cynoscion nebulesus*
Grey trout	*C. regalis*
Bay anchovy	*Anchoa tyrannus*
Alewives	*Alosa pseudoharengus*
Menhaden	*Brevoortia tyrannus*

Source: NESO, 1975.

Table 5.4-3
Benthic Organisms Common to SPNC Offshore Areas

Common Name	Scientific Name	Common Name	Scientific Name
Plant Benthos			
Blue-green algae	Lyngbya	Brown algae	Fucus
	Oscillatoria	Red algae	Gracilaria
Green algae	Ulva		Ceramium
	Enteromorpha		
	Cladophora		
Animal Benthos			
Flounder	Paralichthys	Hard shell clam (quahog)	Mercenaria
Barnacle	Chthamalus	Oyster	Crassotrea
	Balanus	Soft shell clam	Mya
Spider crab	Libina	Razor clam	Ensis
Hermit crab	Pagurus	Short razor clam	Tagelus
Blue crab	Callinectes	Mussel	Modiolus
Rock crab	Cancer		Volsella
Mole crab	Emerita		Mytilus
Horseshoe crab	Xiphosura	Jingle shell	Anomia
Sand dollar	Mellita	Oyster worm	Nercis
Starfish	Asterias	Blood worm	Blycera
Sea urchin	Arabacia	Lug worm	Arenicola
Moon snail	Polinices	Tube worm	Diopatra
Slipper shell	Crepidula	Sea squirt	Mogula
Mud snail	Nassarius		
Oyster drill	Urosalpinx		
Welk	Busycon		

Source: NESO, 1975.

crabs and oysters. As described in section 6.5.1, Water Quality, much of the area is closed to shellfishing, but the larvae still play an important part in the food web of the aquatic ecosystem.

5.4.3 Wetland Ecosystems

As discussed in the previous sections, wetlands on or associated with the SPNC area have been virtually eliminated by dredge and fill operations and by the construction of docking facilities and seawalls. At one time, tidal marsh covered large areas of the NAS NORFOLK, but the increased need for facilities on SPNC in the 1940s led to the filling of these areas, particularly near Mason Creek.

Minor wetlands are currently located in the northwestern section (the Q area) of SPNC and in the southeastern section (the NM area) around Mason Creek. In addition, marshy wetlands are present along small creeks and drainage canals in the NM area which drain into Mason Creek. Small shrub communities, reeds, cordgrass (*Spartina* spp.), and cattails (*Typha latifolia*) occur in the wetlands in the Q area and fringe Mason Creek and its minor tributaries, whereas mixed deciduous, willow woods, and pines occur in the higher, drier areas. Reeds, cordgrass, cattails, and shrubs also occur in the marshy areas surrounding a small lake at the SPNC golf course, which is located west of the NM area.

The wildlife composition in the SPNC wetlands is sparse due to the intense development that has taken place. Birds are the most abundant wildlife form, with blackbirds, marshwrens, and sparrows the most conspicuous. Red-winged blackbirds inhabit marshes and drainages covered by cattails and shrubs. Some wading birds, such as egrets and herons, occasionally hunt the wetland areas, while gulls, terns, and cormorants can be seen in the sparsely vegetated wetland areas.

Mammals in the wetland areas are limited to rabbits, squirrels, and an occasional stray dog or cat. Reptiles include box turtles and rat snakes.

5.4.4 Threatened and Endangered Species

Threatened and endangered species would not be expected to occur on SPNC. Intensive development has altered the original character of the site and rendered most of the area unsuitable for wildlife. Although the site is located along the Atlantic Flyway, an important migration route (especially for waterfowl), the proximity of the Great Dismal Swamp to the southwest and Chesapeake Bay to the northeast limits SPNC's importance to waterfowl. Although on rare occasions a bald eagle, peregrine falcon, or brown pelican might hunt in or over the adjacent waters, more suitable hunting habitats are found in the surrounding area. No other threatened or endangered species of animals would be expected at this site (LANTNAVFACENGCOM, 1976a).

6.0 ACTIVITY FINDINGS

6.1 INDUSTRIAL OPERATIONS

The majority of industrial operations at Sewells Point Naval Complex (SPNC) are performed by five major activities: Naval Air Rework Facility, Norfolk (NAVAIREWORKFAC NORFOLK), Public Works Center, Norfolk (PWC NORFOLK), Naval Air Station, Norfolk (NAS NORFOLK), Naval Station, Norfolk (NAVSTA NORFOLK), and Naval Supply Center, Norfolk (NSC NORFOLK). This section addresses the industrial operations performed by these activities, as well as other activities identified by Commander Naval Base, Norfolk (COMNAVBASE NORFOLK) and Atlantic Division, Naval Facilities Engineering Command (LANTNAVFACENGCOM) personnel as those which could potentially use or generate significant quantities of toxic or hazardous materials (see table 5.1-1).

The industrial operations performed by the five major activities identified in the preceding paragraph are briefly summarized in the following paragraphs. In addition, the types of wastes generated by each activity are identified. Detailed discussions of industrial operations and waste generation and disposal are presented in subsequent sections.

NAVAIREWORKFAC NORFOLK provides major overhaul services for a variety of combat aircraft and constitutes the largest single industrial operation at SPNC. Wastes generated by this activity include a wide range of industrial solvents, cleaning agents, sandblasting waste, metal plating solutions and rinsewaters, and paint stripping waste.

PWC NORFOLK performs a wide range of maintenance-related industrial operations in accordance with its mission to provide maintenance and support services for SPNC. This mission includes general maintenance of buildings and grounds; road repairs; utility services, including electricity, water, sewer, and solid waste collection; vehicle maintenance and repair; and collection of waste oil from oil-water separators and waste oil tanks (bowsers). Several of PWC NORFOLK's operations generate significant quantities of hazardous waste, including paint waste, cleaning solvents, and petroleum, oils, and lubricants (POL).

NAS NORFOLK provides intermediate aircraft maintenance and operations facilities for helicopters and fixed-wing aircraft operating out of SPNC. These operations produce waste, primarily POL and hydraulic fluid. A past aluminum smelting operation generated slag as a waste product.

NAVSTA NORFOLK operates the basic port facilities at SPNC, including berthing, support, and intermediate maintenance for ships of the Atlantic Fleet. Intermediate maintenance for ships is performed by Shore Intermediate Maintenance Activity, Norfolk (SIMA NORFOLK), a tenant of NAVSTA NORFOLK. Wastes produced by SIMA NORFOLK operations are mostly POL but also include small quantities of solvents and industrial cleaning agents.

NSC NORFOLK serves as a warehouse and distribution center, but also performs some of its own equipment maintenance and thus produces some waste POL and solvents. NSC NORFOLK also operates a print shop, which generates spent photographic developing solutions.

Although most of the industrial operations began at SPNC in the 1930s, the generation of significant quantities of waste probably did not begin until the 1940s during World War II. It was reported that the waste generation rates generally have not varied to a significant degree over the years, but it is likely that they were somewhat higher during World War II due to the increased level of activity. In addition, the types of waste currently generated are basically similar to those generated in the past.

With regard to waste disposal, the majority of industrial wastewaters generated at SPNC were discharged to the storm sewer system and ultimately to Willoughby Bay or the Elizabeth River until the early to mid-1970s. At that time, segregating and rerouting of industrial waste streams to the sanitary sewer system were initiated. In addition, the construction of pretreatment facilities for some of the industrial waste streams was undertaken during this time period. Although the majority of industrial wastewaters have been discharged to the storm sewer in the past, several small industrial waste streams have been discharged to the sanitary sewer since the 1930s. From the 1930s until 1946, the sanitary sewer either discharged to a septic tank system or was connected to a combined sewer (stormwater drainage and sanitary wastewater), which discharged directly to the Elizabeth River or Willoughby Bay. In 1946, a separate sanitary sewer system was installed to convey sanitary wastewater to the Hampton Roads Sanitation District (HRSD) sewage treatment plant (STP). Since then, most of the septic tank systems have been abandoned, and the buildings once served by septic tanks are now connected to the sanitary sewer system. Consequently, virtually all of the sanitary wastewater generated at SPNC since 1946 has been conveyed to the HRSD STP.

Other industrial wastes, consisting primarily of various residues and sludges, were generally hauled to the Camp Allen landfill (site 1) for disposal. This landfill began operation in the 1940s. Although no information regarding the disposal of industrial sludges and residues prior to the 1940s was available, it is unlikely that significant quantities of these wastes were generated and disposed of at SPNC during the 1930s. Beginnning in the early to mid-1970s, drumming and stockpiling of these wastes, as well as various organic solvents and chemicals previously discharged to the storm sewer, were initiated. In 1979, contract hauling of these wastes offsite to U.S. Environmental Protection Agency (EPA)-approved hazardous waste disposal facilities began. Stockpiling and disposal of wastes are discussed further in section 6.4, Waste Treatment and Disposal.

Waste POL generally has been transported to the waste oil reclamation facility at the Naval Supply Center-Craney Island Fuel Terminal (NSC-CI) since it was constructed in 1943, and this disposal method for POL is still in practice today. Although no information regarding waste POL disposal prior to 1943 was available, it is unlikely that significant quantities of this waste were generated and disposed of at SPNC during the 1930s and early 1940s.

Detailed discussions of the industrial operations performed by the five major activities (NAVAIREWORKFAC NORFOLK, PWC NORFOLK, NAS NORFOLK, NAVSTA NORFOLK, and NSC NORFOLK), as well as those performed by the other smaller activities identified by COMNAVBASE NORFOLK and LANTNAVFACENGCOM personnel as those which could potentially generate significant quantities of toxic or hazardous waste, are presented in the following sections. In addition, current and past waste generation rates and disposal methods are identified. Waste disposal methods are also addressed in section 6.4, Waste Treatment and Disposal.

6.1.1 NAVAIREWORKFAC NORFOLK

NAVAIREWORKFAC NORFOLK was established in the early 1930s, its mission being to provide depot-level maintenance for naval aircraft. This level of maintenance requires overhaul of all aircraft systems, including airframe, power plant, and avionics. Currently, NAVAIREWORKFAC NORFOLK activities are concentrated on two types of aircraft, the F-14 Tomcat and the A-6E Intruder.

NAVAIREWORKFAC NORFOLK generates the majority of industrial wastewater at SPNC, and, in the past, virtually all of the NAVAIREWORKFAC NORFOLK wastewater was discharged to the storm sewer system and ultimately to Willoughby Bay. In the early 1970s, a pollution control program was conducted to characterize the various waste streams and to identify which streams were amenable to pretreatment for discharge to the sanitary sewer system. As a result of this program, the design of a collection system for wastewaters determined to be amenable to treatment, primarily metal plating rinsewaters, was begun, and, in 1973, the design and construction of an industrial waste treatment plant (IWTP) was begun to provide pretreatment of these wastewaters. The IWTP began operation in 1976, and, since then, the IWTP effluent has been discharged to the HRSD STP, rather than the storm sewer system. The IWTP is discussed in further detail in section 6.4.1, Liquid Waste Treatment and Disposal. In addition, the drumming of concentrated liquid wastes not amenable to treatment, such as metal plating solutions and various organic solvents, was initiated for ultimate disposal of the waste by contract hauling offsite to EPA-approved hazardous waste disposal facilities.

The major waste-generating operations are aircraft paint stripping, parts cleaning, metal plating, and sandblasting, with avionics or electronic instrument repair and aircraft testing as smaller generating operations. These operations are discussed in the following sections.

6.1.1.1 Aircraft Paint Stripping

Aircraft paint stripping has been performed in Bldg. LF-53 since 1972. Prior to 1972, this operation was conducted in Bldg. V-28. The paint stripping operation consists of applying a paint stripper to the aircraft and allowing the stripper to react with the paint. The reacted paint is then manually scraped off onto paper, which is placed under the aircraft on the floor of the hangar. After stripping, the aircraft is washed and examined for corrosion. Prior to painting, the aircraft is wiped with paint thinner to clean the surface.

Since the late 1960s, the waste paper containing the paint stripping residue has been hauled to the SPNC salvage fuel boiler for disposal. Prior to that time, the waste paper and paint stripping residue were presumably hauled to the Camp Allen landfill (site 1) for disposal. Although no information was available regarding the quantity of residue generated, it is estimated that about 100 pounds is generated for each aircraft. In 1981, 100 aircraft underwent paint stripping operations. Consequently, it is estimated that about 10,000 pounds of paint stripping residue was generated in 1981. Although the number of aircraft processed annually has varied, the quantity of paint stripping residue generated in the past and disposed of in the Camp Allen landfill (site 1) probably ranged from about 7,500 to 12,500 pounds per year.

Since 1976, the wash water from the paint stripping operation has been routed to the IWTP for pretreatment prior to discharge to the HRSD STP. Prior to 1976, the wash water was discharged to the storm sewer system and ultimately to Willoughby Bay. No information was available regarding the quantity of wash water generated; however, it is estimated to be about 1,000 gallons for each aircraft. Consequently, when 100 aircraft were processed in 1981, about 100,000 gallons of wash water was generated. The quantity of wash water generated in the past and discharged to Willoughby Bay was probably in the range of about 75,000 to 125,000 gallons per year.

Waste paint stripping chemicals, which include cresol-, acrylic-, and petroleum-based thinners, caustic soda, and various organic solvents (primarily 1,1,1-trichloroethane) are currently placed in drums which are contract hauled offsite to an EPA-approved hazardous waste disposal facility. Drumming and stockpiling these wastes were initiated in the mid-1970s, whereas contract hauling did not begin until 1979. Prior to the mid-1970s, these wastes reportedly were discharged to the storm sewer system and ultimately to Willoughby Bay. Currently, approximately two drums of mixed chemical waste are generated weekly. This generation rate reportedly is similar to past generation rates, and the types of chemicals used in the past were basically the same (Personal Communication, 1982).

6.1.1.2 Parts Cleaning

Two parts cleaning shops are located at NAVAIREWORKFAC NORFOLK, one in Bldg. LP-20 and one in Bldg. V-28. The shop in Bldg. LP-20 handles primarily engine components, while the shop in Bldg. V-28 concentrates on airframe components.

The cleaning agents used in these operations are water-based solutions, such as caustic solutions, and various organic solvents, including 1,1,1-trichloroethane and petroleum solvent (PD 680 Type I). The water-based cleaning solutions and organic solvents and sludge removed from parts cleaning tanks are currently placed in drums and contract hauled offsite for disposal at an EPA-approved hazardous waste disposal facility. Drumming and stockpiling these wastes were initiated in the early to mid-1970s, whereas contract hauling of these wastes did not begin until 1979. Prior to the early 1970s, all of the liquid wastes were discharged to the storm sewer system and ultimately to Willoughby Bay, and the sludge was presumably hauled to the Camp Allen landfill (site 1) for disposal.

An average of less than 1,000 gallons per day of water-based cleaning solutions currently is drummed for offsite disposal, and approximately six drums of mixed organic solvents and sludge are generated weekly and are periodically contract hauled. Reportedly, the types and quantities of these wastes have remained relatively constant throughout the operation's existence (Personal Communication, 1982).

No information was available regarding the quantity of sludge that was most likely hauled to the Camp Allen landfill (site 1) in the past. Based on the current generation rate of drummed waste and the size and cleaning frequency of the parts cleaning baths, it is estimated that about 1,000 to 2,000 gallons of sludge currently is generated per year. Since past waste generation rates were reportedly similar to current rates, it is likely that 1,000 to 2,000 gallons of parts cleaning sludge contaminated with various organic solvents was hauled to the Camp Allen landfill (site 1) annually prior to the early 1970s.

6.1.1.3 Sandblasting

Sandblasting of aircraft components is performed in Bldg. V-28. The dust emitted to the air during this operation is currently collected using a baghouse dust collection system and placed in 55-gallon drums. A sample of the dust was subjected to the extraction procedure (EP) toxicity test (EPA, 1981a) in March 1981 and was found to exceed the maximum contaminant level for cadmium (NAVAIREWORKFAC NORFOLK, 1981a).

Consequently, since then, the drums of dust have been disposed of by contract hauling offsite to an EPA-approved hazardous waste disposal facility. From 1974 until March 1981, when contract hauling of the dust offsite was initiated, the dust reportedly was allowed to accumulate in a pile on the ground outside Bldg. V-28 and was periodically shoveled from the pile into 55-gallon drums and hauled to the CD landfill (site 6) for disposal (Personal Communication, 1982). Prior to 1974, when the CD landfill (site 6) began operation, the dust was presumably disposed of in the Camp Allen landfill (site 1).

In 1981, approximately 10 to 20 drums of the baghouse dust were generated weekly (NAVAIREWORKFAC NORFOLK, 1981a), and, reportedly, past generation rates were similar to the 1981 generation rate (Personal Communication, 1982). However, prior to March 1981, when the dust was allowed to accumulate in a pile outside Bldg. V-28, some of the dust was washed down the storm drains and ultimately into Willoughby Bay by stormwater runoff. Moreover, inspection of the roof of Bldg. V-28 following the determination of the dust as hazardous indicated that considerable quantities of dust had accumulated on the roof as a result of a leak in the baghouse collection system. This problem was resolved; however, the dust accumulating on the roof in the past also was washed down the storm drain and ultimately into Willoughby Bay.

The washing of the cadmium-contaminated dust into the storm drains was cited as the cause of elevated cadmium levels in past stormwater runoff discharges to Willoughby Bay (NAVAIREWORKFAC NORFOLK, 1981a). This resulted in the violation of National Pollutant Discharge Elimination System (NPDES) permit limitations for stormwater runoff at outfall 007. A more detailed discussion of the past NPDES permit violations for the outfalls of the storm sewer system in the NAVAIREWORKFAC NORFOLK area is presented in section 6.4.1, Liquid Waste Treatment and Disposal.

6.1.1.4 Metals Plating

Three metals plating shops are located at NAVAIREWORKFAC NORFOLK in Bldgs. LP-21, LP-20, and V-28. The shops in Bldgs. LP-21 and V-28 were installed in the late 1930s, and the shop in Bldg. LP-20, which currently handles the majority of the plating, was built in 1958. A new plating facility, which will replace the shops now in operation, is in the planning stage. About 200 plating, acid pickling, and caustic cleaning tanks are used in the NAVAIREWORK NORFOLK metals plating operation. A list of the typically used plating, acid pickling, and caustic cleaning baths, as well as typical bath capacities, is shown in table 6.1-1.

An estimated 70,000 gallons per day of rinse water is used to wash acidic, caustic, and metal plating solutions from metal components. The rinse water is currently discharged to the IWTP for pretreatment prior to discharge to the HRSD STP. The contents of concentrated solution tanks, such as metal plating solutions and acid

Table 6.1-1
Typical Metals Plating, Acid Pickling, and Caustic Cleaning Baths Used at NAVAIREWORKFAC NORFOLK (May 1982)

Bath	Capacity (gallons)
Copper Cyanide	500
Electroless Nickel	284
Zincate	207
Nitric Hydrofluoric Acid	128
Sulfamate Nickel	1,500
"Porroclean" Caustic	1,100
Sulfuric Acid	800
Hydrochloric Acid	500
Nickel Chloride	162
Chromic Acid	3,500
Sodium Dichromate	200
Silver Cyanide	600
Cadmium Cyanide	1,450
Ammonium Nitrate (Cadmium)	400
Nickel Strip	
MP-1	1,000
MP-2	1,000
METEX (Cyanide)	1,000
Tin Stannate	145
Lead Tin	76
Phosphate Coating	382

Sources: ESE, 1982.
Personal Communication, 1982.

pickling liquor, including tank bottom sludges, are currently drummed and generally disposed of as a hazardous waste by contract hauling offsite to an EPA-approved hazardous waste disposal facility. An average of six 55-gallon drums of these wastes currently is generated per week. Spent metal plating solutions containing silver are drummed separately and sent to the Defense Property Disposal Office (DPDO) for subsequent silver recovery. Drumming and stockpiling these wastes began in the early to mid-1970s, whereas contract hauling of the wastes did not begin until 1979. Prior to the early to mid-1970s, virtually all liquid wastes, including concentrated metal plating solutions, were discharged to the storm sewer system and ultimately to Willoughby Bay. Tank bottom sludges, primarily metal plating sludges, were presumably hauled to the Camp Allen landfill (site 1) for disposal.

Reportedly, the current waste generation rates identified previously are similar to past generation rates. Although no information is available regarding the past quantity of sludge hauled to the Camp Allen landfill (site 1), it is estimated to be about 1,000 gallons per year. This estimation is based on the current generation rate of drummed waste and the assumption that 5 percent of the drummed waste consists of sludge.

6.1.1.5 Avionics

The avionics shop has been located in Bldg. LF-18 for 26 years. Prior to that time, the shop was in Bldg. V-88, in the areas on each side of the hangar currently used as office space. Aircraft electronic components, including navigation, communication, and weapons systems, are repaired in the avionics shop.

Freon and 1,1,1-trichloroethane are used as cleaning solvents in the maintenance and repair of electronic equipment. Freon has been used for approximately 10 years and 1,1,1-trichloroethane for approximately 5 to 10 years. Prior to the use of these two solvents, the naphtha-based solvent Varsol was used as a cleaning solvent.

Avionics generates approximately four or five drums per year of waste solvents, which are currently disposed of as a hazardous waste by contract hauling offsite to an EPA-approved hazardous waste disposal facility. Drumming and stockpiling these wastes began in the mid-1970s, whereas contract hauling of these wastes did not begin until 1979. Prior to the mid- to late-1970s, the spent solvents (freon and 1,1,1-trichloroethane) were most likely discharged to the sanitary sewer system through drains located in the shop and conveyed to the HRSD STP. Prior to the early 1970s, when Varsol was used as the cleaning solvent, the spent Varsol was hauled to the waste oil reclamation facility at NSC-CI.

6.1.1.6 Aircraft Testing

Upon completion of aircraft overhaul, a plane is taken to Bldg. LP-167 where it is tested for flight readiness. In this facility, all aircraft systems are tested using engine and auxiliary power. Bldg. LP-167 has been used for aircraft testing since 1971. Prior to its construction, several other hangars in the same area were used. These hangars were demolished to accommodate new construction in that area.

Lubricating oils, hydraulic fluid, and JP-5 fuel are the wastes generated at this facility. These materials are collected in a bowser and hauled to the waste oil reclamation facility at NSC-CI. This waste disposal method reportedly has been practiced throughout this operation's existence. Approximately 800 gallons per year of these waste products is disposed of from this facility, and it was reported that this waste generation rate has not varied significantly over the years (Personal Communication, 1982).

6.1.2 PWC NORFOLK

Operation and maintenance of SPNC support facilities, including buildings, grounds, roads, sewers, and utilities, are the responsibilities of PWC NORFOLK. In addition, PWC NORFOLK operates and maintains vehicles for general transportation and collects and disposes of solid wastes. These functions, which have been part of SPNC in approximately their current form since 1941, are now divided among the PWC NORFOLK operating departments. Four of these departments perform industrial operations, as described in the following sections.

6.1.2.1 Maintenance

The Maintenance Department of PWC NORFOLK provides general maintenance for the various buildings at SPNC. This includes interior painting, general repair, pest control, and landscaping. The shops which support these operations (carpentry shop, paint shop, and machine shop) are located in Bldg. Z-140; the pest control shop is located in a small adjacent building (Bldg. Z-194), which is described in section 6.3.3.

The maintenance shops have been housed in Bldg. Z-140 for at least 15 years. During this period of time, the nature and volume of work performed have remained essentially constant. Consequently, the amount of waste currently generated should be a reliable indicator of historic conditions.

Most painting done by PWC NORFOLK is general office redecoration, which generates a limited amount of waste. The east end of Bldg. Z-140, however, houses two wet curtain spray paint booths which are used periodically. The booths are reportedly cleaned once a year by discharging the recirculation water to the sanitary sewer system, which conveys the wastewater to the HRSD STP, and manually removing the remaining paint sludge. The paint sludge is currently drummed and contract hauled offsite to an EPA-approved hazardous waste disposal facility. Drumming and stockpiling this waste was initiated in the mid-1970s, whereas contract hauling of this waste did not begin until 1979. Prior to the mid-1970s, the sludge was hauled to the Camp Allen landfill (site 1) for disposal.

During the cleaning of each spray paint booth, about 200 gallons of spent recirculation water is discharged to the sanitary sewer and about 10 gallons of sludge is removed. Consequently, approximately 400 gallons of wastewater and 20 gallons of paint sludge are generated annually by the cleaning of both spray paint booths.

Machining work in Bldg. Z-140 consists of precision cutting and grinding of parts from heavy machinery undergoing repairs at operating locations. No toxic or hazardous wastes are generated by this operation.

Wood is not pressure treated in the carpentry work area, but wood finishes and preservatives are brush applied. Virtually all of these materials are consumed in this operation.

6.1.2.2 Oil Recovery

PWC NORFOLK provides waste oil recovery as a service to other activities at SPNC. PWC NORFOLK personnel and equipment are used to pump oil from oil-water separators and waste oil holding tanks (bowsers) located throughout SPNC. The oil is pumped into a tank truck, which transports it to barges located at the piers on the western shore of SPNC. These barges, known as ships waste offloading barges (SWOBs), also receive waste oil/oily waste offloaded from ships moored at the piers. In addition, oil and fuel recovered from spills in the water around the piers using booms and mechanical skimmers are pumped into the SWOBs. The SWOBs, which are operated by NAVSTA NORFOLK Port Services, then transport the combined waste oil/oily waste to the NSC-CI waste oil reclamation facility (see section 6.1.4). Consequently, PWC NORFOLK oil recovery provides a service whereby waste oil/oily waste is collected for transport by NAVSTA NORFOLK Port Services to NSC-CI. However, toxic or hazardous wastes are not currently generated or have not been generated in the past in providing this service.

While the existing capabilities for the cleanup of spills in the water are less than 10 years old, the recovery of waste oil/oily waste has been practiced at SPNC since 1943, when the waste oil reclamation facility at NSC-CI was built. Although no information was available regarding the disposal of waste oil/oily waste prior to 1943, it is unlikely that significant quantities of these wastes were generated at SPNC in the 1930s and early 1940s.

As mentioned previously, PWC NORFOLK oil recovery personnel collect waste oil from bowsers and oil-water separators located throughout SPNC. The bowsers are generally located near any operation that generates waste oil, and oil-water separators are used to treat oily wastewater, which is typically generated at vehicle wash racks. An operation where a bowser is used and an oil-water separator is currently being installed to treat wash-rack wastewater is the PWC NORFOLK motor pool located in Bldg. A-80 (see section 6.1.2.3, Transportation). Reportedly, the use of bowsers for the collection of waste oil has been practiced for at least the past 30 years. However, the use of oil-water separators for the treatment of oily wastewater from vehicle wash racks prior to discharge to the sanitary sewer was only begun within the last 10 years. Previously, wash rack wastewater generally was discharged directly to the storm sewer, rather than to the sanitary sewer following gravity oil-water separation.

6.1.2.3 Transportation

The principal industrial operation performed by the PWC NORFOLK Transportation Department is the maintenance and repair of motor vehicles and heavy equipment. Since 1955, heavy equipment has been repaired in Bldg. A-80, and automobiles and light trucks have been repaired in the motor pool (Bldg. A-81). From 1939 to 1955, this operation was located in Bldg. W-130.

Vehicle maintenance performed by PWC NORFOLK ranges from oil changes to engine rebuilding, including hydraulic system repair for heavy equipment. Bldg. A-80 contains two vehicle wash racks and a solvent degreasing bath, and Bldg. A-81 houses one wash rack and two wet curtain spray paint booths.

It was reported that the solvent degreasing bath, with a capacity of approximately 150 gallons, is changed about once every 2 months, and petroleum solvent (PD 680 Type 1) has been used as the degreasing solvent for at least the last 20 years. The spent solvent is poured into a bowser, which is also used to store waste oil and hydraulic fluid. Approximately 600 gallons of waste oil and 700 gallons of spent hydraulic fluid are generated monthly. Consequently, a total of about 900 gallons of spent solvent, 7,200 gallons of waste oil, and 8,400 gallons of spent hydraulic fluid is generated annually, and the combined waste is periodically hauled to the NSC-CI waste oil reclamation facility. This oil recovery procedure has been practiced since 1943.

Oil-water separators are currently being installed at each of the three vehicle wash racks in Bldgs. A-80 and A-81 to provide treatment of the wastewater prior to discharge to the sanitary sewer system. Previously, the oily wastewater was discharged directly to the storm sewer system. No information was available regarding the total volume of wastewater generated at the three vehicle wash racks; however, it probably averages less than a thousand gallons per day.

The two wet curtain spray paint booths in Bldg. A-81 are cleaned about twice a year by discharging the recirculation water to the sanitary sewer and manually removing the remaining sludge. The paint sludge is currently drummed and periodically hauled offsite to an

EPA-approved hazardous waste disposal facility. Drumming and stockpiling the sludge began in the mid-1970s, whereas contract hauling of the sludge did not begin until 1979. Prior to the mid-1970s, the sludge was hauled to the Camp Allen landfill (site 1) for disposal.

During the cleaning of each paint booth, approximately 200 gallons of spent recirculation water is discharged to the sanitary sewer, and approximately 10 gallons of sludge is removed. Consequently, about 800 gallons of wastewater and 40 gallons of sludge are generated annually by cleaning the two spray paint booths.

PWC NORFOLK also performs maintenance on material handling equipment, primarily forklifts, in Bldg. V-49. Approximately 500 gallons of waste oil is generated per year and is stored in a bowser prior to being hauled to the NSC-CI waste oil reclamation facility. This disposal method has been practiced since the 1940s. In addition, a steam cleaning operation, which is used for removing oil, grease, and dirt from equipment, is located outside Bldg. V-49. Oily wastewater generated by this operation reportedly drains to an oil-water separator, and the separator effluent is discharged to the sanitary sewer. Waste oil removed from the separator is hauled to the NSC-CI waste oil reclamation facility. Although no information was available regarding past wastewater disposal, it is likely that prior to about 10 years ago the oily wastewater was discharged directly to the storm sewer, rather than the sanitary sewer, and ultimately to Willoughby Bay. It is estimated that about 100 to 200 gallons per day of wastewater is generated by the steam cleaning operation.

6.1.2.4 Utilities

The PWC NORFOLK Utilities Department operates and maintains the water and sewer systems, the boiler plants, including the salvage fuel boiler (see section 6.4.2), and the associated electrical supply systems on SPNC. Most maintenance is performed in the field, and no significant quantities of hazardous waste are generated by these maintenance operations. The Utilities Department does, however, handle and store electrical transmission equipment, such as transformers, which may contain polychlorinated biphenyls (PCBs) (see section 6.3.4).

6.1.3 NAS NORFOLK

The existing NAS NORFOLK facilities at SPNC were established during the 1940s. These facilities, including hangars and maintenance shops, are operated by the Aircraft Intermediate Maintenance Department (AIMD) and a number of naval squadrons. AIMD provides intermediate or "I"-level maintenance for fixed-wing aircraft and helicopters, while the squadrons perform only operational or routine maintenance and repairs of fixed-wing aircraft and helicopters. In addition, an aluminum smelting operation was reportedly conducted from the 1950s until the mid-1960s. These operations are discussed in detail in the following sections.

6.1.3.1 AIMD

"I"-level maintenance of aircraft has been a function of NAS NORFOLK since approximately 1950. Originally, this operation was a small-scale effort housed in a single building, but it grew as naval aircraft became more complex and widely used. As a result, waste quantities steadily increased over the years to their present level. No information was available regarding past waste quantities due to the lack of pertinent records. Moreover, the rapid turnover of AIMD personnel precluded the gathering of information on past quantities through interviewing employees with extended service. AIMD currently occupies eight buildings, including a hangar, shops, and offices. AIMD offers "I"-level maintenance to all aircraft at SPNC. This maintenance can include engine overhauls, airframe work, and electrical and hydraulic systems repairs. This work is performed upon request from fixed-wing and helicopter squadrons requiring repair work that is beyond their operations or "O"-level maintenance capabilities. "O"-level maintenance activities include routine tasks such as changing oil.

Internally, AIMD is divided into several sub-functions, consisting of avionics, which involves instrument and control systems repairs, engine and propeller repair, hydraulic systems repair, nondestructive testing, airframe repair, and maintenance of support hardware or "yellow gear," such as generators and materials handling equipment. Avionics is performed in Bldg. SP-213 and does not generate significant waste quantities because of the relatively low level of activity in this shop.

Bldgs. SP-313, SP-38, and SP-10 house the engine and propeller repair shops. These shops generate a total of approximately 100 gallons per month of combined waste oil and hydraulic fluid. This waste is stored in a bowser and is periodically hauled to the NSC-CI waste oil reclamation facility. In addition, about 100 gallons of spent 1,1,1-trichloroethane from a degreasing bath is poured into the bowser about once every 2 or 3 months. 1,1,1-Trichloroethane most likely has been used as a degreaser for approximately the last 10 years, and trichloroethylene (TCE) was probably used previous to that time. Consequently, about 1,200 gallons of combined waste oil and hydraulic fluid and 400 to 600 gallons of spent TCE are generated annually. Disposing of these wastes at the NSC-CI waste oil reclamation facility has been practiced throughout this operation's existence.

In addition to the wastes identified above, paint wastes are also generated by the use of a small wet curtain spray paint booth. Although no information was available regarding the cleaning frequency of the paint booth, the booth is probably cleaned once or twice a year, based on its usage. Cleaning is accomplished by discharging the recirculation water to the sanitary sewer system and manually removing the paint sludge. Approximately 100 gallons of recirculation water is discharged, and approximately 5 gallons of sludge is removed during each cleaning. Therefore, 100 to 200 gallons of wastewater and 5 to

10 gallons of sludge are generated annually by this operation. The sludge is currently drummed and periodically contract hauled offsite to an EPA-approved hazardous waste disposal facility. Drumming and stockpiling of the sludge began in the early to mid-1970s, but contract hauling of the sludge did not begin until 1979. Prior to the early to mid-1970s, the sludge was presumably hauled to the Camp Allen landfill (site 1) for disposal.

Hangar Bldg. LP-14 houses the hydraulic repair and nondestructive testing operations. Although nondestructive testing does not generate toxic or hazardous waste, hydraulic repair work generates approximately 50 gallons per month of spent hydraulic fluid. This waste is stored in a bowser and periodically hauled to the NSC-CI waste oil reclamation facility. This disposal method has also been practiced in the past.

No toxic or hazardous wastes are generated by the airframe repair operation, which is located in Bldg. SP-142.

Maintenance of support hardware, which is conducted in Bldgs. SP-145 and SP-147, generates an estimated 25 gallons per month of waste oil. The waste oil is stored in a bowser and periodically hauled to the NSC-CI waste oil reclamation facility. This disposal method has also been practiced in the past.

6.1.3.2 Squadrons

Both fixed-wing and helicopter squadrons currently operate out of SPNC. Each squadron maintains an "O"-level maintenance facility where squadron personnel perform routine maintenance, repairs, and parts replacement. Squadron operations are conducted in the hangars, LP-13, LP-3, LP-12, LP-2, and SP-1, SP-2, and SP-31. Naval air squadrons began operating from SPNC during World War II, and the NAS NORFOLK expansion during the post war years included additional runway and hangar facilities. Operation and maintenance of naval aircraft have been a sizable portion of the SPNC activity since 1950. There are currently about 20 squadrons in operation at SPNC, but the number of squadrons has varied widely over the years.

Wastes generated by "O"-level maintenance are limited to small quantities of waste oil and hydraulic fluid estimated to be about 50 to 100 gallons a month per squadron. Although the number of squadrons has varied, the total generation of waste oil and hydraulic fluid has probably ranged from as low as 500 to as high as 3,000 gallons per month. Currently, as well as in the past, this waste has been stored in bowsers and periodically hauled to the NSC-CI waste oil reclamation facility.

6.1.3.3 Past Aluminum Smelting Operation

It was reported that an aluminum smelting operation was conducted from the 1950s until the mid-1960s in Bldg. NM-59C, which has since been demolished. This operation was performed to recover aluminum from aircraft components and was probably conducted by NAS NORFOLK, although no information was available to specifically identify NAS NORFOLK as the activity responsible for this operation.

The past site of the smelter (Bldg. NM-59C) is located on a concrete-paved surface north of Bldg. NM-95 in the naval magazine (NM) area of the southeastern portion of SPNC. Inspection of this site indicated that the undeveloped area west of the past smelter site was used as a dumping area for the slag generated by the smelting operation. The resulting slag pile (site 2), which covers an area of about 2 acres, is discussed further in section 6.4, Waste Treatment and Disposal.

6.1.4 NAVSTA NORFOLK

Servicing and maintenance of ships visiting or based at SPNC are NAVSTA NORFOLK's primary responsibilities and include defueling and refueling, utilities hookups, onboard intermediate maintenance, and coordination of ship movements within the harbor. These basic functions have always been part of the overall operations at SPNC, but the specific tasks currently performed by NAVSTA NORFOLK have changed over time to keep pace with the evolution of naval vessels.

Berthing and support services are provided by NAVSTA NORFOLK Port Services, whereas SIMA NORFOLK, a tenant of NAVSTA NORFOLK, performs intermediate maintenance operations. These two activities are discussed in the following sections.

6.1.4.1 Port Services

The main industrial functions of NAVSTA NORFOLK Port Services are onloading, offloading, and handling of fuels and oils used aboard ship. This includes operating SWOBs to receive waste oil/oily waste offloaded from ships and operating and maintaining booms and "donuts," which are floating oil-water separators. The booms are used to contain potential spillage that may occur during loading/offloading of fuel and oily waste, and the donuts are used to treat offloaded oily waste generated during tank cleaning or other onboard maintenance. In the event of an oil spill to surface waters, Port Services works with PWC NORFOLK oil recovery personnel in the cleanup operation.

The existing system for controlling oily discharges to surface waters has been in use for about 10 years; however, the use of SWOBs to receive waste oil/oily waste offloaded from ships has been in practice since the 1940s. In addition, the SWOBs also receive waste oil collected by PWC NORFOLK from the various bowsers and oil-water separators located throughout SPNC. At the current level of operations, which is reportedly representative of the period since the 1940s, Port Services transports about three SWOBs containing waste oil/oily waste to NSC-CI for oil reclamation each week. The capacity of each barge is approximately 77,000 gallons, and the barge contents are comprised of about 75 percent oil and 25 percent water. As mentioned previously, the bowsers located throughout SPNC are used mainly for the collection of waste oil, but they also may have been used in the past by some industrial operations for the collection of chlorinated degreasing solvents, primarily 1,1,1-trichloroethane and TCE. However, the percentage of chlorinated solvents in the total quantity of waste oil hauled to the NSC-CI waste oil reclamation facility is likely to be extremely low on the average and, reportedly, has not caused any significant problems with the waste oil reclamation process.

As described previously, NAVSTA NORFOLK Port Services receives and transports waste oil/oily waste to NSC-CI but does not generate waste in providing this service.

6.1.4.2 SIMA NORFOLK

SIMA NORFOLK is located in four buildings (W-129, CEP-189, CEP-19, and CEP-107) on NAVSTA NORFOLK. SIMA NORFOLK's function is to provide periodic maintenance of naval vessels to extend service life before major maintenance is required. Most of the maintenance work is conducted in three shops, the pump shop, the diesel shop, and the rigging shop.

Wastes currently generated are carbon remover and waste oil from the diesel shop and 1,1,1-trichloroethane used for parts degreasing in the pump shop and rigging shop. Approximately 150 gallons of waste carbon remover, 400 gallons of spent 1;1,1-trichloroethane and 300 to 400 gallons of waste oil are generated annually. No records of past waste generation rates and disposal were available, and due to the rapid turnover of SIMA NORFOLK personnel, information regarding past waste generation and disposal could not be gathered through employee interviews.

The spent carbon remover and 1,1,1-trichloroethane are currently drummed and periodically contract hauled offsite to an EPA-approved hazardous waste disposal facility. The waste oil is currently hauled to the NSC-CI waste oil reclamation facility and has most likely been disposed of in this manner in the past. It is likely that the spent carbon remover and degreasing solvent were discharged to the storm sewer and ultimately to the Elizabeth River prior to the early- to mid-1970s. It is also possible that the degreasing solvent may have been combined with the waste oil and hauled to the NSC-CI oil reclamation facility. TCE was probably used as a degreasing solvent in the past, rather than 1,1,1-trichloroethane.

6.1.5 NSC NORFOLK

Industrial operations performed by NSC NORFOLK are limited to maintenance of materials handling equipment and transport vehicles and printing.

Maintenance of materials handling equipment and transport vehicles is performed in Bldgs. Y-100 and W-130. Work includes general maintenance on warehousing equipment, such as forklifts and overhead cranes, and it was reported that this work currently generates about 200 gallons of waste oil and degreasing solvent (1,1,1-trichloroethane) per year. This waste is periodically hauled to the NSC-CI waste oil reclamation facility. NSC NORFOLK has performed its own maintenance within the last 5 years in an effort to reduce equipment downtime. Prior to 5 years ago, this work was performed by PWC NORFOLK. It was reported by NSC NORFOLK personnel that the past levels of activity and resulting waste generation rates were similar to current levels (Personal Communication, 1982).

Many of the forklifts used by NSC NORFOLK are battery powered, but used batteries are not reprocessed or drained onsite. NSC NORFOLK replaces batteries with new units and turns used ones over to DPDO.

NSC NORFOLK has operated a print shop, which is located in Bldg. W-143, for the last 12 years. Although the waste generation rates have remained relatively constant throughout the operation of this shop, the waste disposal methods have varied. Approximately 3 gallons of photographic developer, cleaning bath, and fixer solutions is generated weekly by the photographic processor. These solutions have been discharged to the sanitary sewer and conveyed to the HRSD STP throughout the shop's operation. In addition, approximately 6 gallons of waste blanket wash, a hydrocarbon-freon mixture, and ink are generated each week. For the first 10 years of operation, these wastes were also discharged to the sanitary sewer; however, for the last 2 years, these wastes have been placed in cans and disposed of in a dumpster, and the combined waste in the dumpster is ultimately taken to the SPNC salvage fuel boiler for disposal. No silver recovery is practiced at this shop due to the low volumes of silver-containing waste generated.

6.1.6 Other Activities

This section addresses the industrial operations performed by activities other than the five major activities discussed in the preceding sections. Seventeen other activities were identified by COMNAVBASE NORFOLK and LANTNAVFACENGCOM personnel at the beginning of the Initial Assessment Study (IAS) as those which could potentially use or generate significant quantities of toxic or hazardous materials; however, only eight of these activities perform industrial operations that generate significant waste quantities. These eight activities are: SIMA NORFOLK, Shore Intermediate Maintenance Activity, Portsmouth (SIMA PORTSMOUTH), Fleet Marine Force Atlantic Fleet (FMFLANT) (Camp Elmore), Armed Forces Staff College (AFSC), Navy Printing and Publications Office (NPPSO), Fleet Training Center (FTC), Construction Battalion Unit 411 (CBU-411), and Commander in Chief, U.S. Atlantic Fleet (CINCLANTFLT). Detailed discussions of the industrial operations performed by each of these activities, excluding SIMA NORFOLK [which was addressed previously in section 6.1.4 (NAVSTA NORFOLK)], are presented in the following sections.

During the course of the IAS onsite survey, LANTNAVFACENGCOM personnel identified industrial operations in addition to the five major activities and the eight other activities identified previously. These operations include vehicle maintenance and repair conducted in two automobile hobby shops operated by NAVSTA NORFOLK Personnel Support, a photograph processing shop operated by the Fleet Intelligence Center, Europe/Atlantic (FICEURLANT), and a photograph processing shop operated by the Supreme Allied Command, Atlantic (SACLANT). However, the types of wastes produced by these operations are similar to those generated by the other activities, and the waste disposal methods for these operations are consistent with those practiced by the other activities. Furthermore, the quantity of waste generated by these operations is insignificant relative to that generated by the other activities at SPNC. Consequently, detailed discussions of these industrial operations are not presented.

6.1.6.1 SIMA PORTSMOUTH

SIMA PORTSMOUTH is a tenant of NAS NORFOLK. The primary function of SIMA PORTSMOUTH is to provide repair and refitting of various small boats, including gigs, launches, and lifeboats, that are associated with aircraft carriers of the Atlantic Fleet, as well as boats from other ships.

Repair operations include stripping, patching, and repainting of fiberglass hulls, engine overhauls, and installation of new woodwork and electronic gear. Much of this work, particularly hull stripping and painting, is done outside in the yard between Bldgs. V-36 and V-38 which SIMA PORTSMOUTH occupies. The SIMA PORTSMOUTH function within NAS NORFOLK was established in 1974, and SIMA PORTSMOUTH has reportedly occupied its present location since 1977. Due to a high personnel turnover, no information was available about SIMA PORTSMOUTH activities between 1974 and 1977. However, past operations were presumably similar to their current form, and waste generation rates and disposal methods were presumably similar to those currently reported.

Bldg. V-38 houses engine overhaul facilities, including a 150-gallon petroleum solvent (PD 680 Type 1) degreasing tank and a steam cleaning unit. Since 1977, the solvent tank has been cleaned approximately four times a year by removing the contents. The spent solvent is placed in a bowser, which also receives less than 25 gallons per month of waste lubricating oil drained from engine crankcases. Consequently, a total of about 600 gallons of spent solvent and 300 gallons of waste oil is generated annually by this operation. These wastes are periodically hauled to the NSC-CI waste oil reclamation facility.

Steam cleaning of engine parts is conducted outside Bldg. V49 but is performed only once or twice a month. Less than 20 gallons of oily wastewater is generated by this operation, and the wastewater drains into the storm sewer and ultimately to Willoughby Bay. This oily waste stream will reportedly be routed to the sanitary sewer system in 1985/1986.

Bldg. V-36 houses the supply storage area, canvas shop, carpentry shop, and upholstery shop. A large bay at the east end of the building is used for painting and hull preparation. Hull sanding produces an estimated 5 to 10 pounds per month of paint and fiberglass dust, which likely contains metals originally present in the paint. Since about 1979, the dust has been vacuumed from the ground surface using an industrial vacuum, placed in drums, and periodically contract hauled offsite to an EPA-approved hazardous waste disposal facility. Prior to 1979, the dust was left on the ground surface and was eventually washed down the storm drain by stormwater runoff and ultimately discharged to Willoughby Bay.

Materials used in the maintenance and repair of boat hulls at SIMA PORTSMOUTH include a variety of paints, varnishes, fiberglass resins, and thinners. Varnishes are applied with a brush; painting is performed with brushes and hand-held sprayers. Virtually all of these materials, except thinners used to clean brushes and spray equipment, are consumed by their use. About 5 gallons of waste thinner is generated monthly, and is placed in drums and periodically contract hauled offsite to an EPA-approved hazardous waste disposal facility.

6.1.6.2 FMFLANT (Camp Elmore)

The only significant industrial operation conducted by FMFLANT (Camp Elmore) is vehicle maintenance, which occurs in the motor pool, which has been in operation since the 1940s. This motor pool, which is located in Bldgs. MCE-60 and MCE-65, provides operational maintenance (parts changing, oil changes, and engine tuneups) and similar routine tasks for 49 vehicles. About 100 to 200 gallons of waste oil and petroleum degreasing solvent (PD 680 Type 1) is generated annually by this operation. This waste is periodically hauled to the NSC-CI waste oil reclamation facility. Although it was reported that past waste generation rates are similar to current rates, information regarding past waste disposal methods was not available. It is likely that the waste oil and solvent has been hauled to NSC-CI throughout the operation of the Camp Elmore motor pool.

6.1.6.3 AFSC

AFSC has been in operation since 1963, and the only industrial wastes generated by AFSC are spent photographic developing solutions. Approximately 20 gallons per year of spent developing solutions and 100 to 150 gallons per year of fixer solution containing silver are generated by the photograph processing operation, which is located in

Bldg. SC-1. The spent developing solutions are discharged to the sanitary sewer and conveyed to the HRSD STP, whereas the fixer solution is periodically hauled offsite through DPDO for subsequent silver recovery. These disposal methods have reportedly been practiced since AFSC began operation.

6.1.6.4 NPPSO

NPPSO operates a print shop, which has been located in Bldg. KBB since 1968. From the 1940s until 1968, the shop was located in Bldg. U-6, which was demolished in 1968. NPPSO has practiced silver recovery on the waste photographic developing solutions for the last 8 years, prior to discharging them to the sanitary sewer, which conveyed them to the HRSD STP. Prior to that time, the waste solutions were discharged untreated to the sanitary sewer and conveyed to the HRSD STP. No records of waste quantities were available; however, based on the size of the operation, less than 2,000 gallons of spent photographic developing solution is generated per year.

6.1.6.5 FTC NORFOLK

FTC NORFOLK operates a firefighting training school in the southwest corner of SPNC. This facility, which was established at its current location in 1942, contains structures used to simulate fires in fixed-wing aircraft, helicopters, and ship engine rooms. These structures are fired using JP-4, diesel fuel, propane, or unleaded motor vehicle gasoline (MOGAS). This facility is also used to train personnel in the use of oxygen breathing apparatus (OBA).

Oily wastewater from the site has historically been disposed of by routing it through an oil-water separator, then discharging it to a storm drain that flows into the Elizabeth River. The quantity of waste oil removed from the separator has reportedly averaged about 50,000 gallons per year, and it has been hauled periodically to the NSC-CI waste oil reclamation facility. The oily wastewater will soon be treated in the oily wastewater treatment plant (OWTP), which is currently under construction at the site, and the OWTP effluent will be discharged to the HRSD STP.

OBA cannisters contain potassium superoxide, sodium chlorate, and barium peroxide as oxygen generators. Until April 1982, spent cannisters still containing some of these materials were taken to the DPDO storage yard in the Camp Allen area of SPNC, where they were stored while awaiting sale. When it was discovered that rainwater entering the cannisters was producing caustic runoff (pH>11), this procedure was discontinued. Since April 1982, a new disposal method has been practiced. The spent cannisters are rinsed with water to flush out the remaining contents. The cannisters and the caustic rinsewater are then contract hauled offsite to an EPA-approved hazardous waste disposal facility. Currently, about 250 spent cannisters and 220 gallons of caustic rinseate are generated per week.

6.1.6.6 CBU-411

Established as a shore duty station in 1971, CBU-411 performs general construction and renovation work and maintains several items of construction equipment and trucks. Personnel turnover in this unit is high, so historical information was limited. However, current waste generation is reportedly 10 gallons per month of cleaning solvent (1,1,1-trichloroethane) and 70 gallons per month of waste oil. The solvent is reportedly drummed and periodically contract hauled offsite to an EPA-approved hazardous waste disposal facility. Prior to 1979, when contract hauling began, the drums of solvent were stockpiled.

6.1.6.7 CINCLANTFLT

A small photograph processing shop is operated under CINCLANTFLT in Bldg. NH-17. About 25 gallons of spent photographic developing solution is generated monthly, and this solution is periodically hauled offsite through DPDO for subsequent silver recovery. No historical information was available for this shop; however, the existing waste generation rate and disposal method are presumably similar to past generation rates and disposal methods.

6.1.7 Summary of Industrial Waste Generation and Disposal

Table 6.1-2 summarizes the types and quantities of industrial waste generated and the methods of waste treatment and disposal practiced by the industrial operations at SPNC addressed in this section.

The waste generation rates presented in table 6.1-2 indicate that the most significant quantities of industrial wastewater previously discharged to Willoughby Bay consisted of aircraft paint stripping wastewater, water-based parts cleaning solutions, metals plating rinsewaters and solutions, and vehicle wash rack wastewater. In addition to industrial wastewater, waste paint stripping chemicals and various organic solvents have been discharged in considerable quantities to Willoughby Bay in the past. Table 6-1.2 also indicates that significant quantities of industrial waste consisting of paint stripping residue, parts cleaning sludges, sandblasting dust contaminated with cadmium, and metal plating sludges, were disposed of in the Camp Allen landfill (site 1) in the past. In addition, the CD landfill (site 6) was used for the disposal of the cadmium-contaminated dust from 1974, when the Camp Allen landfill (site 1) was closed, until March 1981.

The types and quantities of industrial wastes generated by NAVAIREWORKFAC NORFOLK, NAS NORFOLK, and PWC NORFOLK are presented in Salveson and Fruh (1977) and NAVAIREWORKFAC NORFOLK (1981b). This information was compared with that presented in table 6.1-2, which is predominantly based on personnel interviews. This comparison indicated that the basic types of wastes presented in table 6.1-2 were similar to those reported in Salveson and Fruh (1977) and NAVAIREWORKFAC NORFOLK

Table 6.1-2
Summary of Industrial Waste Generation, Treatment, and Disposal

Operation	Period of Operation	Industrial Wastes	Current Annual Waste Generation Rate	Current Treatment Method	Current Disposal Method	Past Disposal Method
NAVAIREWORKFAC NORFOLK						
Aircraft Paint Stripping	1930s to present	Paper/paint stripping residue	7,500 to 12,500 lbs	None	Salvage fuel boiler	Camp Allen landfill (site 1)
		Wash water	75,000 to 125,000 gal	IWTP	Sanitary sewer	Storm sewer/Willoughby Bay
		Waste paint stripping chemicals	5,700 gal	None	Contract hauled	Storm sewer/Willoughby Bay
Parts Cleaning		Water-based cleaning solutions	<300,000 gal	None	Contract hauled	Storm sewer/Willoughby Bay
		Various organic solvents	15,000 to 16,000 gal	None	Contract hauled	Storm sewer/Willoughby Bay
		Sludge	1,000 to 2,000 gal	None	Contract hauled	Camp Allen landfill (site 1)
Sandblasting		Cadmium-contaminated dust	29,000 to 57,000 lbs	None	Contract hauled	CD landfill (site 6) and Camp Allen landfill (site 1)
Metals Plating		Rinse water	18,200,000 gal	IWTP	Sanitary sewer	Storm sewer/Willoughby Bay
		Metal plating solutions, spent acids and caustics	17,000 gal	None	Contract hauled	Storm sewer/Willoughby Bay
		Metal plating sludges	1,000 gal	None	Contract hauled	Camp Allen landfill (site 1)
Electronic Instrument Repair		Spent solvents (1,1,1-trichloroethane, freon)	220 to 275 gal	None	Contract hauled	Sanitary sewer
		Varsol	220 to 275 gal	NA*	NA	NSC-CI†
Aircraft Testing		Waste POL	800 gal	None	NSC-CI	NSC-CI

Table 6.1-2
Summary of Industrial Waste Generation, Treatment, and Disposal
(Continued, Page 2 of 4)

Operation	Period of Operation	Industrial Wastes	Current Annual Waste Generation Rate	Current Treatment Method	Current Disposal Method	Past Disposal Method
PWC NORFOLK Painting	1930s to present	Paint booth wastewater	400 gal	None	Sanitary sewer	Sanitary sewer
		Paint booth sludge	20 gal	None	Contract hauled	Camp Allen landfill (site 1)
Vehicle Maintenance		Spent degreasing solvent, waste oil, spent hydraulic fluid	17,000 gal	None	NSC-CI	NSC-CI
		Vehicle wash rack wastewater	<260,000 gal	Oil-water separators	Sanitary sewer	Storm sewer/Willoughby Bay
		Paint booth wastewater	800 gal	None	Sanitary sewer	Sanitary sewer
		Paint booth sludge	40 gal	None	Contract hauled	Camp Allen landfill (site 1)
NAS NORFOLK AIMD-Maintenance of Aircraft	1930s to present	Spent degreasing solvent, waste oil, and spent hydraulic fluid	2,500 to 2,700 gal	None	NSC-CI	NSC-CI
		Paint booth wastewater	100 to 200 gal	None	Sanitary sewer	Sanitary sewer
		Paint booth sludge	5 to 10 gal	None	Contract hauled	Camp Allen landfill (site 1)
Squadrons-Maintenance of Aircraft		Waste oil, spent hydraulic fluid	500 to 3,000 gal	None	NSC-CI	NSC-CI
NSC NORFOLK Vehicle Maintenance	1930s to present	Waste oil, spent degreasing solvent	200 gal	None	NSC-CI	NSC-CI

Table 6.1-2
Summary of Industrial Waste Generation, Treatment, and Disposal
(Continued, Page 3 of 4)

Operation	Period of Operation	Industrial Wastes	Current Annual Waste Generation Rate	Current Treatment Method	Current Disposal Method	Past Disposal Method
NSC NORFOLK (continued)						
Printing		Spent photographic developing solutions	160 gal	None	Sanitary sewer	Sanitary sewer
		Spent solvents, waste ink	300 gal	None	Sanitary sewer	Salvage fuel boiler
SIMA NORFOLK	1940s to present					
Ship Maintenance		Carbon remover, spent solvent	550 gal	None	Contract hauled	Storm sewer/Elizabeth River
		Waste oil	300 to 400 gal	None	NSC-CI	Contract hauled
SIMA PORTSMOUTH	1974 to present					
Boat Maintenance		Spent degreasing solvent	600 gal	None	Contract hauled	NSC-CI
		Waste oil	300 gal	None	NSC-CI	NSC-CI
		Oily wastewater	<240 gal	None	Storm sewer/ Willoughby Bay	Storm sewer/Willoughby Bay
		Paint and fiberglass dust	60 to 120 lbs	None	Contract hauled	Washed into storm sewer/ Willoughby Bay
		Waste paint thinner	60 gal	None	Contract hauled	Contract hauled
FMFLANT (CAMP ELMORE)						
Vehicle Maintenance	1940s to present	Waste oil, degreasing solvent	100 to 200 gal	None	NSC-CI	NSC-CI
AFSC	Early 1960s to present					
Photograph Processing		Spent photographic developing solution	20 gal	None	Sanitary sewer	Sanitary sewer
		Spent hypo solution containing silver	100 to 150 gal	None	Hauled off-site for silver recovery	Hauled offsite for silver recovery

Table 6.1-2
Summary of Industrial Waste Generation, Treatment, and Disposal
(Continued, Page 4 of 4)

Operation	Period of Operation	Industrial Wastes	Current Annual Waste Generation Rate	Current Treatment Method	Current Disposal Method	Past Disposal Method
NPPSO Printing	1940s to present	Spent photographic developing solutions containing silver	<2,000 gal	Silver recovery	Sanitary sewer	Sanitary sewer with no silver recovery
FTC NORFOLK Firefighting Training	1942 to present	Waste POL	50,000 gal	Oil-water separator	NSC-CI	NSC-CI
		OBA cannisters	13,000	None	Contract hauled	Sold
		OBA caustic rinse-water	11,400 gal	None	Contract hauled	NA
CBU-411 Maintenance of Construction Equipment and Vehicles	1971 to present	Waste oil	840 gal	None	NSC-CI	NSC-CI
		Degreasing solvent	120 gal	None	Contract hauled	Contract hauled
CINCLANTFLT Photograph Processing	1940s to present	Spent photographic developing solutions	300 gal	None	Hauled off-site for silver recovery	Hauled offsite for silver recovery

* NA = Not applicable.
† NSC-CI = Naval Supply Center-Craney Island waste oil reclamation facility.

Source: ESE, 1982.

(1981b). However, the waste quantities presented in table 6.1-2 for NAVAIREWORKFAC NORFOLK, NAS NORFOLK, and PWC NORFOLK represent about 60 percent of the waste reportedly (Salveson and Fruh, 1977; NAVAIREWORKFAC NORFOLK, 1981b) generated by these activities. The waste quantities presented in table 6.1-2 are lower because numerous small auxiliary industrial operations performed by these activities could not be addressed due to the limited timeframe for the IAS onsite survey. Nevertheless, the information presented in table 6.1-2 shows that significant quantities of hazardous or toxic wastes were discharged to Willoughby Bay and disposed of in the Camp Allen and CD landfills (sites 1 and 6, respectively) in the past.

6.2 LABORATORY OPERATIONS

Four major activities at SPNC currently operate laboratory facilities: NAVAIREWORKFAC NORFOLK, NAS NORFOLK, NAVSTA NORFOLK, and NSC NORFOLK. In the following sections, each activity and the laboratories they operate are discussed separately. Types and quantities of hazardous wastes generated currently and in the past are identified. In addition, current, as well as past, waste disposal methods are described.

6.2.1 NAVAIREWORKFAC NORFOLK

There are three major laboratory operations under the direction of NAVAIREWORKFAC NORFOLK. These include the materials engineering laboratory, the instrument calibration laboratory, and the nondestructive testing laboratory. The following sections discuss current and historical hazardous waste generation and disposal practices for each of these laboratories.

6.2.1.1 Materials Engineering Laboratory

The materials engineering laboratory, which tests plating solutions, has been located in Bldg. V-88 for the past 20 years. Prior to this, a small laboratory operation located in Bldg. V-28 generated waste acids, which were diluted, flushed down the sink drains, and ultimately drained into Willoughby Bay via the storm sewer system.

The laboratory operation in Bldg. V-88 generates waste acids, bases, solvents, and plating solutions. Currently, approximately 1 gallon of acid and base wastes, including nitric acid, sulfuric acid, acetic acid, chromic acid, and sodium hydroxide, is generated every few months, and 5 gallons per month of each of the following solvents is generated: methanol, acetonitrile, hexane, chloroform, freon, and carbon tetrachloride. The laboratory also generates approximately 5 gallons per month of plating solution containing chromic acid. Waste acids and bases have been discarded by dilution and subsequent disposal to the sink drains since this laboratory began operation. In the past, the sink drains were connected to the storm sewer systems, which discharged to Willoughby Bay; however, in late 1970, the sink drains were rerouted to the sanitary sewer system to convey wastes to the HRSD STP. Prior to 1970, waste solvents and plating solutions were also discarded by flushing down the sink drains, which, at that time, led to the storm sewer system and ultimately to Willoughby Bay. Beginning in 1970, waste non-water-soluble solvents and plating solutions were drummed and stockpiled, and contract hauling of the drums began in 1979. However, the disposal method for water-soluble solvents continued to be flushing down the sink drains, which have been connected to the sanitary sewer leading to the HRSD STP since 1970.

Volumes of wastes generated have not varied significantly since the laboratory's inception, and disposal has always been by means of flushing down the sink drains.

6.2.1.2 Instrument Calibration Laboratory

The instrument calibration laboratory has been located in a section of the first floor of Bldg. V-88 since 1962. Prior to 1962, it was located in Bldg. LF-18. The laboratory is responsible for the calibration of instruments from the Atlantic Fleet and naval installations throughout the eastern United States. Small quantities of hazardous waste are generated by the laboratory. Less than 1 gallon of TCE and freon is utilized per year for cleaning purposes; this has and continues to be dumped down the sink drains. In the late 1970s, the sink drains reportedly were connected to the sanitary sewer system, which discharges to the HRSD STP. Prior to that time, the drains were connected to the storm sewer system, which ultimately discharged to Willoughby Bay.

The laboratory is equipped with a mercury distillation apparatus, which has been in operation since 1962. The mercury contained in the instruments undergoing calibration is drained into the still for refining, after which it is placed back into the instrument. The laboratory refines approximately 25 pounds of mercury per year and generates approximately 1 pound of mercury-contaminated still bottom wastes per year. Currently, the still bottoms are contract hauled offsite to an EPA-approved hazardous waste disposal facility. Placing the mercury waste in containers for stockpiling began in the early 1970s, but contract hauling of the waste did not begin until 1979. Prior to the early 1970s, the still bottoms were hauled to the Camp Allen landfill (site 1) for disposal. A mercury distillation apparatus was not present in the laboratory prior to 1962, and mercury removed from the instruments undergoing calibration was either placed back in the instruments or replaced by new unused mercury. It is probable that contaminated mercury removed from the instruments was disposed of in the Camp Allen landfill (site 1).

6.2.1.3 Nondestructive Testing Laboratory

The nondestructive testing laboratory, located in Bldgs. V-27 and LP-20, examines materials for heat damage, primarily by X-ray.

X-rays have been utilized in Bldg. LP-20 since the 1950s. During this time, approximately 10 gallons of X-ray developer solution and 10 gallons of fixer solution have been generated per week. X-rays have been used in Bldg. V-27 for the past 8 years. During this time, approximately 60 gallons of developer solution and 60 gallons of fixer solution have been generated per week. The fixer solution in both buildings is processed for silver recovery and then discharged down the sink drain. It was reported that the silver recovery system has been in operation for 2 years, and, prior to that time, all X-ray wastes were discharged down the drain without silver recovery. In the late 1970s, the drain system was reportedly connected to the sanitary sewer system, which discharges to the HRSD STP. Prior to this, the drains were connected to the storm sewer, which discharged into Willoughby Bay.

6.2.2 NAS NORFOLK

NAS NORFOLK has operated a photographic laboratory in Bldg. V-64 since 1942. Since the late 1940s, the developing and fixing solutions used in film processing (approximately 50 gallons of waste solutions per month) have been discharged to the sanitary sewer system, which leads to the HRSD STP. Prior to that time, the waste solutions were reportedly discharged to the storm sewer system and ultimately to Willoughby Bay. Recovery of silver from the waste solutions was initiated in 1973, and from 1942 until 1973, silver recovery was not practiced. Prior to the early 1960s, the laboratory was a much larger operation and generated approximately 5,000 gallons per month of waste developing and fixing solutions.

The laboratory also serves as the storage and subsequent supplier of developing and fixing solutions for numerous naval bases worldwide. Currently, the laboratory stores 1,000 gallons of developing and fixing solutions.

Until the early 1960s, photoprocessing chemicals were supplied as powders, and solutions were mixed in the laboratory. Consequently, no out-of-date chemicals were generated. In the early 1960s, the laboratory began using premixed solutions. Premixed solutions that exceeded their recommended shelf life have been sent to PWC NORFOLK (early 1960s until early 1970s) or to DPDO (early 1970s until the present) for recycling, sale, or disposal.

6.2.3 NAVSTA NORFOLK

Three major laboratories operate on SPNC. These are the Navy Regional Dental Center (NRDC) laboratory, the Navy Regional Medical Center (NRMC) laboratory, and the drug screening laboratory, which are further discussed in the following sections.

6.2.3.1 NRDC Laboratory

The NAVSTA NORFOLK NRDC has been in existence since 1942. For the past year, it has been located in Bldg. CD-3; prior to that time, it was located in Bldg. A-50. The dental clinic laboratory generates hazardous wastes in the form of scrap amalgam containing mercury and silver; metal filings containing beryllium, nickel, and chromium; and waste X-ray developing solutions.

Scrap amalgam is stored at the clinic until several pounds have accumulated. For the last 10 years, the scrap amalgam has been sent to the Defense Logistics Agency (DLA) at Colts Neck, N.J., for silver recovery processing at a rate of approximately 250 pounds of amalgam per year. Prior to the early 1970s, the amalgam waste generation was reportedly about 150 pounds per year, and the material was reportedly sold to contractors.

Metal filings containing beryllium, nickel, and chromium are generated at the clinic during the production of prosthetics. Since the 1950s, approximately 8 gallons of these filings have been collected every 3 months using a vacuum system and stored in a 55-gallon drum. Since the early 1970s, PWC NORFOLK has been collecting the partially filled 55-gallon drums on a quarterly basis. The drums have been stockpiled, and, in 1979, contract hauling of the drums offsite to an EPA-approved disposal facility was initiated. Prior to the early 1970s, approximately 6 gallons per quarter of waste filings were generated and were presumably disposed of in the Camp Allen landfill (site 1).

During approximately the last 10 years, NRDC has produced roughly 50 gallons of spent X-ray solutions annually, which has been sent to DPDO for silver recovery. Before the early 1970s, spent X-ray solutions were presumably discharged without silver recovery via sink drains to the sanitary sewer system, which conveyed the solutions to the HRSD STP.

6.2.3.2 NRMC Laboratory

The NRMC laboratory has been located in Bldg. CD-2 since 1975. Prior to this, NRMC managed some laboratory operations in Bldg. S-33. The NRMC laboratory generates basically three categories of hazardous wastes: spent disinfectants and cleaning solutions, infectious wastes, and spent X-ray solutions.

Since moving to Bldg. CD-2 in 1975, NRMC has been generating approximately 5 gallons per week of spent cleaning solutions and disinfectants, including alcohols. These wastes are discharged into sinks, which drain to the sanitary sewer systems and eventually to the HRSD STP. Prior to 1975, when the NRMC laboratory was located in Bldg. S-33, approximately the same volume of these wastes was generated, and the wastes were also disposed of down the drains and eventually discharged to the HRSD STP.

Infectious wastes (e.g., bandages, syringes, microscope slides) generated at NRMC are now and have been in the past double wrapped in plastic bags and disposed of by incineration at Bldg. CD-2. The amount of infectious wastes generated varies but averages several pounds per week.

NRMC currently generates spent X-ray solution at an estimated rate of less than 200 gallons per month. The spent solutions have been discharged down the drain to the sanitary sewer system and eventually to the HRSD STP, and these solutions have been processed for silver recovery prior to discharging down the drain since 1975. Prior to 1975, when NRMC was located in Bldg. S-33, no silver recovery system was used. It is estimated that approximately 40 gallons per month of waste X-ray solution was produced during that period.

6.2.3.3 Drug Screening Laboratory

The drug screening laboratory has been located in Bldg. S-33 since its inception 7 years ago. It generates radioactive iodine (iodine-125) wastes from radioimmunoassay studies. Iodine-125 is a gamma emitter with a 60-day half-life.

During recent months, the laboratory reportedly has been generating three 55-gallon drums of radioactive-contaminated solid wastes (glass tubes containing antibody-antigen complexes) and 15 gallons of radioactive-contaminated phosphate buffer solutions every 2 weeks. In the past, fewer radioimmunoassay studies were performed, and the waste accumulation rate was approximately one-third of the current rate.

The radioactive-contaminated solids are currently placed in plastic-lined 55-gallon drums. When the drums are filled, they are measured for radiation level by a gamma counter, dated, labeled as radioactive, and stored in a locked area of the laboratory. From the radiation level measurements and known half-life statistics, a calculation is made to determine when the radioactive-contaminated solids will decay to background levels. The solids are generally kept approximately 1 year and then tested by a gamma counter. When the solids have decayed to background levels, the radioactive label is removed, and the drums are sent to the Norfolk Naval Shipyard (NORFOLKNAVSHIPYD) for incineration.

From 1975, when the drug screening laboratory began operation, until 1979, the radioactive solids were hauled offsite by a hazardous waste contractor. Because of the high cost associated with contract hauling and problems in finding approved disposal facilities, this practice was discontinued in 1979, and the current disposal practice, as outlined above, was initiated. Since 1979, the laboratory has been storing a maximum of 26 drums containing materials awaiting decay. Because the waste generation rate has tripled during the last few months due to an increase in the number of immunoassays and because of limited storage space for the increased number of drums, the laboratory is currently investigating acquiring another hazardous waste contractor.

Spent radioactive-contaminated solutions are poured into 5-gallon carboys, measured by a gamma counter, dated, labeled as radioactive, and stored in a locked area of the laboratory. These solutions are kept several months and then measured by a gamma counter to verify that they are at background levels. When the background level has been reached, the solutions are poured down the sinks, which drain to the sanitary sewer system and eventually to the HRSD STP. This disposal practice for the spent radioactive-contaminated solutions has been in effect since the inception of the drug screening laboratory.

Monitoring for excess radiation exposure, including the use of personnel badges, has been ongoing since the inception of the laboratory, and no contamination has been indicated by the personnel badges. Occasional spills are handled with a decontamination kit, and all spills are reported to the Radiation Safety Officer (RSO) of the Nuclear Medicine Branch of the NRMC. The Nuclear Medicine Branch checks all spill areas for residual contamination after cleanup. All cleanup materials are placed in drums and handled as radioactive-contaminated solids. This includes measuring with a gamma counter, dating, labeling as radioactive, and storing the items until the cleanup materials have decayed to background levels. The materials have either been hauled offsite by a hazardous waste contractor or incinerated at NORFOLKNAVSHIPYD, as discussed previously for radioactive-contaminated solids.

6.2.4 NSC NORFOLK

NSC NORFOLK operates a fuels laboratory, which has been located in Bldg. W-388 since October 1981. From 1943 until October 1981, it was located on the sixth floor of Bldg. W-143. The fuels laboratory tests various petroleum products, including aircraft turbine fuel, jet fuel, gasolines, and lubricating materials. Analyses conducted include knock ratings, octane number, lead content, ash content, flash point, and explosiveness.

The laboratory utilizes and generates as wastes several solvents (hexane, acetone, benzene, toluene, and chloroform), some reagents (particularly chlorides and nitrates), and waste petroleum-derived samples. Currently, the solvents and high flash (greater than 212 degrees Fahrenheit flash point) samples are poured into a 600-gallon underground sump. The sump is pumped out approximately two times every 9 weeks, and the waste is either hauled by tank truck to NSC-CI for reprocessing or sold to a contractor. The waste reagents are flushed down the drain connected to the sanitary sewer system, which conveys them to the HRSD STP. Low flash point solvents and waste samples are placed in a drum and hauled off by the fire department for use at the firefighting school, which is under the direction of the FTC.

When the fuels laboratory was located in Bldg. W-143, it generated approximately the same types and quantities of wastes. The wastes were not segregated based on flash point, but were combined and placed in 5-gallon cans that were hand-carried and dumped into a tank truck. The wastes were then either hauled to NSC-CI for reprocessing or sold to a contractor. The waste reagents were flushed down the sink drains, which were reportedly connected to the sanitary sewer system leading to the HRSD STP in the late 1970s.

Prior to that time, the sinks drained into the storm sewer, which ultimately drained into the Elizabeth River.

6.2.5 Summary of Laboratory Waste Generation

Table 6.2-1 summarizes the types and quantities of laboratory wastes generated and the methods of waste treatment and disposal practiced by each laboratory discussed in the preceding sections. As shown in the table, considerable quantities of spent X-ray developing solutions containing silver were discharged to the storm sewer system and ultimately to Willoughby Bay in the past.

6.3 MATERIAL HANDLING AND STORAGE

6.3.1 POL

Three major bulk POL storage areas exist at SPNC. Two areas supply the ships moored at piers located along the eastern shore of SPNC. These storage areas are located on the north end of piers across from pier 5 in the W area and at the south end of the piers across from pier 20 in the CEP area. The third storage area, aircraft fuel stores, is located on the northwest side of Gray Field in the LP area of the north-central portion of SPNC. In addition to these major bulk storage areas, the SP area, located in the northeastern portion of SPNC, and the V area, located in the north-central portion of SPNC, also contain POL storage tanks of significant capacity. Storage tank capacities and the type of product stored in each tank are shown in table 6.3-1. The three waste oil tanks in the V area (V-93-1, V-93-2, and V-93-3) shown in table 6.3-1 are used for temporary storage of waste oil collected from small tanks and drums located in the various shops at NAVAIREWORKFAC NORFOLK. These tanks are periodically pumped out by PWC NORFOLK personnel (see section 6.1.2.2), and the contents are taken to NSC-CI for reclamation.

6.3.1.1 POL Distribution

POL is distributed from the bulk storage areas by both pipeline and tank truck. The main fuel products, such as DFM and JP-5, are pumped to the docks by pipeline, while smaller shipments of any fuel, and generally all MOGAS and AVOIL, are trucked to the user. Airfield fuels are trucked to the various refueling locations.

Collection of waste oil generated throughout SPNC is the responsibility of PWC NORFOLK and NAS NORFOLK. Port Services is responsible for offloading waste oil/oily waste from ships and

Table 6.2-1
Summary of Laboratory Waste Generation, Treatment, and Disposal

Laboratory Operation	Period of Operation	Laboratory Wastes	Current Annual Waste Generation Rate	Current Treatment Method	Current Disposal Method	Past Disposal Method
NAVAIREWORKFAC						
Materials Engineering Laboratory	1950s to present	Plating solutions	60 gal	None	Contract hauled	Storm sewer/Willoughby Bay
		Spent solvents	60 gal	None	Contract hauled	Storm sewer/Willoughby Bay
		Spent acids and bases	4 gal	Dilution	Sanitary sewer	Storm sewer/Willoughby Bay
Instrument Calibration Laboratory	1940s to present	Spent solvents (TCE, freon)	2 gal	Dilution	Sanitary sewer	Storm sewer/Willoughby Bay
		Mercury-contaminated material	1 lb	None	Contract hauled	Camp Allen landfill (site 1)
Nondestructive Testing Laboratory	1950s to present	Spent X-ray developing solutions	1,680 gal	Silver recovery	Sanitary sewer	Storm sewer/Willoughby Bay with no silver recovery
NAS NORFOLK						
Photographic Laboratory	1942 to present	Spent photographic developing solutions	600 gal	Silver recovery	Sanitary sewer	Storm sewer/Willoughby Bay with no silver recovery
NAVSTA NORFOLK						
NRDC Laboratory	1942 to present	Scrap amalgam	250 lbs	None	Hauled offsite for silver recovery	Contract hauled
		Metal filings	32 gal	None	Contract hauled	Camp Allen landfill (site 1)
		Spent X-ray developing solutions	50 gal	None	Sent to DPDO for silver recovery	Sanitary sewer without silver recovery
NRMC Laboratory	1950s to present	Spent cleaning solutions	260 gal	None	Sanitary sewer	Sanitary sewer
		Infectious wastes	150 lbs	Wrapped in plastic bags	Incineration	Incineration
		Spent X-ray developing solutions	2,400 gal	Silver recovery	Sanitary sewer	Sanitary sewer without silver recovery
Drug Screening Laboratory	1975 to present	Radioactive-contaminated solids	Seventy-five 55-gal drums	Storage until decayed	Incineration	Contract hauled
		Radioactive-contaminated solutions	400 gal	Storage until decayed	Sanitary sewer	Sanitary sewer
NSC NORFOLK						
Jet Fuels Laboratory	1943 to present	Spent solvents and samples	7,000 gal	None	Hauled to NSC-CI or contract hauled	Hauled to NSC-CI or contract hauled
		Spent reagents	100 gal	None	Sanitary sewer	Storm sewer/Elizabeth River

Source: ESE, 1982.

Table 6.3-1
Tank Capacities--SPNC

Product*	Tank Number†	Capacity (gallons)
JP-5	LP-39	221,000
	LP-40	229,000
	LP-41	543,000
	LP-42	538,000
	LP-15 Sec. 1	67,000
	LP-15 Sec. 2	67,000
	LP-16 Sec. 3	67,000
	LP-16 Sec. 4	67,000
	LP-161	24,000
	W-144	87,000
	W-145	87,000
	CEP-3	1,092,000
DFM	W-67	1,974,000
	W-68	1,974,000
	W-109	2,226,000
	W-110	2,226,000
	CEP-1	1,092,000
	CEP-2	1,092,000
MOGAS	LP-109	13,000
	LP-110	13,000
	LP-111	13,000
	V-112-1	14,000
	V-112-2	14,000
	W-360	87,000
	W-361	87,000
AVGAS	SP-340	238,000
	SP-341	238,000
	SP-342	565,000
	SP-343	564,000
AVOIL	LP-54-A	24,000
	LP-54-B	24,000
	LP-54-C	24,000
	LP-54-D	24,000
Waste Oil	V-93-1	4,500
	V-93-2	4,500
	V-93-3	4,500

* JP-5 = Jet fuel.
DFM = Diesel fuel marine.
AVGAS = Aviation gasoline.
AVOIL = Aviation oil.

† The prefixes LP, W, and CEP of the tank identification number indicate the area in which the tank is located.

Sources: NAS NORFOLK, n.d.
ESE, 1982.

transporting it using SWOBs to NSC-CI. These activities are described in more detail in sections 6.1.2.2 and 6.1.4.2.

6.3.1.2 Oil Spills

In 1979, oil pollution problems were discovered near piers 4, 5, and 7 (site 14) and piers 20 to 22 (site 15). An estimated 100 gallons per day of oil was seeping from the seawall and contaminating the waters around piers 4, 5, and 7. At piers 20 to 22, the seepage was much smaller and more intermittent in occurrence. A study was undertaken to determine the source of the seepage and the extent of the underground oil contamination behind the seawall at each location (Environmental Resources Management, Inc., 1980). The study, completed in April 1980, found that oil had accumulated behind the seawall in these pier areas as a result of leaks in the pier fuel distribution system. The oil had apparently built up over a long period of time. A french drain system was installed behind the seawall in the area of piers 4, 5, and 7 to recover the spilled oil. Approximately 50,000 gallons of oil, which appeared to be DFM, was recovered from the french drain system using pumps. The french drain system is periodically inspected for the accumulation of additional oil, but it was reported that none has been detected. A drain system was not installed in the area of piers 20 to 22 because of the small amount of oil contamination found in the soils in that area. No free oil was found in this area.

No other significant spills were reported to have occurred at SPNC, although numerous small spills (less than 100 gallons) frequently occur in the pier area as a result of fueling operations (Personal Communication, 1982).

6.3.1.3 Waste Products

There are three sources of waste oil/oily waste at the bulk storage areas: valve pit wastes, waste oil from oil-water separators, and tank cleaning wastes.

Valve pit waste consists of leakage from the valves in the POL distribution system and stormwater runoff which collects in the pit. This oily waste is pumped from the pits and is barged to NSC-CI for reclamation. The quantity of this oily waste varies depending on valve leakage and the amount of rainfall in the area. Historically, this waste has always been sent to NSC-CI for reclamation.

Oil-water separators were installed in early 1982 to treat stormwater runoff that collects inside the berms which surround the tanks in the tank farm areas. Oily waste from the separators will be recovered and sent to NSC-CI for reclamation. Prior to the installation of oil-water separators, stormwater runoff from the tank farm was discharged directly to the Elizabeth River or Willoughby Bay.

Tank cleaning wastes are generated when a storage tank is drawn down and the accumulated settleable contaminants in the tank are removed. Cleaning is performed on an as-needed basis and generally occurs once every several years. Currently, this tank sludge is sent to NSC-CI for oil reclamation and disposal. In the late 1950s, tank bottom wastes from the cleaning operation were reportedly buried on the tank farm grounds, but only 200 to 300 gallons of this material was buried. This practice was discontinued thereafter, and the tank bottom waste has been sent to NSC-CI since then. In 1979, a leaded MOGAS tank was cleaned in preparation for the storage of lubrication oil. The bottom sludge was reportedly subjected to the EP toxicity test (EPA, 1981a) and found to be hazardous because of a high lead content (Personal Communication, 1982). Consequently, this material was sent to NSC-CI, combined with other tank bottom sludge with elevated lead levels, and ultimately disposed of by contract hauling to an EPA-approved hazardous waste disposal facility.

6.3.1.4 Spill Containment

During the 1970s, spill prevention control and countermeasure (SPCC) plans were developed for the fuel storage areas at SPNC. Berms, leak detection devices, sumps, and oil-water separators were installed and are now in place and operating in accordance with applicable regulations. Any spills which do occur are investigated and cleaned up by PWC NORFOLK oil recovery personnel with the help of contractors, if needed.

6.3.2 Chemicals

Hazardous chemical items at SPNC are stored, handled, and disposed of by various activities. The major activities involved and their specific chemical handling/storage responsibilities are discussed separately in the following sections.

6.3.2.1 NAVAIREWORKFAC NORFOLK

NAVAIREWORKFAC NORFOLK is responsible for numerous industrial practices involving the use of numerous different hazardous chemicals. The chemicals are acquired through NSC NORFOLK, and minimal storage of in-stock items is maintained by the various shops throughout the NAVAIREWORKFAC NORFOLK area. Currently, storage areas are properly maintained. Incompatible chemicals were not observed being stored together. A discussion of NAVAIREWORKFAC NORFOLK laboratory practices is presented in section 6.2.

6.3.2.2 PWC NORFOLK

PWC NORFOLK has responsibility for two major areas of hazardous chemical storage and disposal: (1) pesticides used in SPNC areas other than the golf courses and (2) PCB-containing electrical items taken from service by PWC NORFOLK. Pesticides and PCBs are discussed in detail in sections 6.3.3 and 6.3.4, respectively. In addition, PWC NORFOLK has been responsible for the cleanup of hazardous chemical spillage and for the physical handling of damaged hazardous commodities since 1979. Prior to that time, these two tasks were performed by the individual activities located throughout SPNC responsible for the chemical spillage or damage to the hazardous commodity. Since that time, PWC NORFOLK has been transporting and storing damaged hazardous commodities and contaminated materials resulting from the cleanup of hazardous chemical spills. Cells 1 through 4 of Bldg. SDA-215 have been used for the storage of these damaged commodities and contaminated materials. The damaged hazardous commodities that can be potentially recycled or sold are demilitarized and repackaged. DPDO then acquires paper accountability of these commodities; however, PWC NORFOLK retains physical custody of them. DPDO is responsible for arranging the recycle or sale of these commodities, as well as overage chemicals, and PWC NORFOLK relinquishes physical custody of the commodities upon their recycle or sale. If these commodities or overage chemicals cannot be recycled or sold, PWC NORFOLK arranges for the disposal of them by contract hauling offsite to EPA-approved hazardous waste disposal facilities. Currently, PWC NORFOLK uses the first four cells of Bldg. SDA-215 for hazardous material storage, handling, and repackaging. The cells are used as follows:

Cell Number	Use
1	Repackaging and demilitarizing of commodities
2	Contractor use
3	Material for which DPDO has accountability
4	Overflow and PCB storage

As previously mentioned, prior to 1979, individual activities at SPNC responsible for the spillage of hazardous chemicals also were responsible for spill cleanup and disposal of resulting hazardous wastes. In addition, the individual activities were responsible for the disposal of their damaged hazardous commodities during that time period. Prior to the early to mid-1970s, hazardous wastes resulting from spill cleanup were generally hauled to the Camp Allen landfill (site 1) for disposal, and damaged hazardous commodities were generally hauled to the Camp Allen salvage yard located adjacent to this landfill. Overage chemicals also were hauled to the Camp Allen salvage yard during that time period. The salvage operation, which was conducted until 1973 by PWC NORFOLK, was similar to the current procedure used by PWC NORFOLK and DPDO with regard to the handling of damaged or overage hazardous materials. However, materials which could not be recycled or sold were generally disposed of in the Camp Allen landfill (site 1), rather than contract hauling them offsite. These hazardous materials included various chlorinated organic solvents, acids, bases, paint thinners, and pesticides.

In 1971, a fire broke out in the northeastern section of the Camp Allen salvage yard. The fire is believed to have been the result of incompatible chemical storage. Although a complete account was not available, materials reportedly involved in the fire included acids, caustics, paint thinners, various organic solvents, waste oils, and possibly pesticides. Materials remaining in the area after the fire, including many drums with indistinguishable labels, were buried in trenches dug to the southeast of the salvage yard. Further discussion on this disposal site, which is considered part of the Camp Allen landfill (site 1), is presented in section 6.4, Waste Treatment and Disposal.

In 1973, DPDO assumed management of the Camp Allen salvage yard, and Bldg. SDA-215 was used for the stockpiling of hazardous materials that could not be recycled or sold, rather than using the Camp Allen landfill (site 1) for their disposal.

6.3.2.3 NSC NORFOLK

NSC NORFOLK stores, handles, and ultimately transfers for disposal many items used by SPNC and used onboard naval vessels. The following discussion concerns only chemical items handled by NSC NORFOLK. A computerized listing of chemical storage by building for NSC NORFOLK is available on the sixth floor of Bldg. W-143.

Chemicals are received and stored at several buildings within NSC NORFOLK. The basic chain of custody for the chemicals is as follows. The commodity is received at the appropriate storage building. If it has less than two-thirds of its shelf life remaining, the supervisor at the building will send the commodity to Naval Supply, Bldg. W-143. Naval Supply may send the item back to the manufacturer or arrange to have the commodity used by one of the vessels or other facilities it services. If upon receipt the item has more than two-thirds of its shelf life remaining, then it is classified Ready For Inventory (RFI) and is stocked. From the time the item is stocked until it reaches its expiration date, it is available for movement to either the vessels or other facilities serviced by NSC NORFOLK. Upon expiration, PWC NORFOLK transportation personnel are notified to pick up the commodity and deliver it to DPDO for disposal. DPDO recycles overage chemicals within the Department of Defense (DoD) or other Federal agencies or arranges for the chemicals to be taken by State agencies for use in school and university laboratories. These items also may be sold to chemical contractors for recovery. DPDO will not accept physical custody of certain hazardous materials for which NSC NORFOLK requests disposal. DPDO, however, accepts paper accountability and processes the recycling or sale of these items, with NSC NORFOLK storing the items until transfer elsewhere.

Materials in the NSC NORFOLK area for which DPDO will not accept physical custody are processed by DPDO and sent to Bldg. SDA-215, which is a warehouse consisting of nine cells specially designed for hazardous waste storage, handling, and repackaging. As described in the preceding section, PWC NORFOLK uses cells 1 through 4 of Bldg. SDA-215 for repackaging, demilitarizing, and storing hazardous materials. NSC NORFOLK utilizes the remaining cells (cells 5 through 9) of Bldg. SDA-215 as follows:

Cell Number	Use
5	Corrosives
6	Out-of-service due to fire damage
7	Flammable storage
8	Paint and epoxy storage
9	Oxidizer storage

The method of moving commodities through NSC NORFOLK described in the preceding paragraphs has been used since the installation of DPDO began operation at SPNC in 1973. Prior to that time, a similar procedure was used, with the commodities being sent to the Camp Allen salvage yard under PWC NORFOLK control.

NSC NORFOLK also is responsible for storage and handling of tens of thousands of 55-gallon drums containing new products in an open, earthen storage yard in the Q area. Most of these drums contain various petroleum products, but some contain chemicals, including corrosives, formaldehyde, ketones, freons, chlorinated degreasing solvents, and pesticides. Soil in much of the yard has been darkened due to leakage and spillage over the years. This is particularly evident in the yard's northwest corner, where damaged and leaking drums are held. The contamination in the Q area drum storage yard (site 3) is discussed further in section 6.4, Waste Treatment and Disposal.

Two fires have occurred in NSC NORFOLK chemical storage areas that have resulted in the release of contaminated runoff. One fire occurred in Bldg. SDA-215, and the other occurred in Bldg. X-136. The following description of a fire that took place in Bldg. SDA-215 on 12 Aug 1981 was condensed from the Environmental Evaluation prepared by the Utilities, Energy, and Environmental Division of LANTNAVFACENGCOM (1981a), with additional information from interviews as appropriate.

On 12 Aug 1981, a fire broke out in cell 6 of Bldg. SDA-215 (site 17) due to incompatible chemical storage, predominantly of calcium hypochlorite, acids, and organic solvents, which generated various types of solid residue requiring cleanup and disposal. The fire and applied water damaged some of the hazardous materials stored in the adjacent cells (cells 5 and 7). A contractor, Resource Technology Service in Devon, Pa., was hired by NSC NORFOLK to clean up and decontaminate the site. Solid residues within cell 6, primarily melted steel structures, hazardous material containers, and small quantities of damaged hazardous materials had been containerized and transported offsite to an EPA-approved hazardous waste disposal site by 20 Aug 1981. Additional damaged hazardous materials in cells 5 and 7 and soils adjacent to cells 6 and 7, that were contaminated by runoff generated during the fire extinguishing and subsequent cleanup operations, were also containerized and shipped offsite to the EPA-approved hazardous waste disposal site.

The contents of cell 6 before the fire are itemized in appendix D. The majority of these materials were either incinerated in the fire or flushed to the storm drainage system during firefighting activities. After all contaminated materials not destroyed by the fire were removed and disposed of, slag and fire residue within cell 6 were hydroblasted repeatedly. This high-pressure water blasting was adequate to remove the vast majority of dust, metal slag, and other chemical residue within cell 6.

Potential soil contamination on the west side of the building was expected due to ponding and poor surface drainage near cells 6 and 7 of Bldg. SDA-215. Soil removal efforts consisted of the excavation of approximately 6 inches of soil along the length of cells 6 and 7 between the loading dock and the existing concrete roadway. The soil was containerized and shipped to the EPA-approved hazardous waste disposal site mentioned previously.

On 18 Jul 1979, another chemical fire occurred in NSC NORFOLK Bldg. X-136 (site 16). The fire was caused by incompatible chemical storage, predominantly of calcium hypochlorite, acids, and organic solvents. Naval Base, Norfolk (NAVBASE NORFOLK) firefighters flushed approximately 2 tons of calcium hypochlorite to the storm drain. The Virginia State Water Control Board (SWCB) and the U.S. Coast Guard were informed of this flushing procedure. No damage to the aquatic environment was observed following this incident.

6.3.2.4 DPDO

DPDO is located at the South Depot Annex and in the Camp Allen area in the southwestern portion of SPNC, where it receives excess property from activities throughout SPNC and other DoD facilities. This property is recycled within DoD or other Federal or State agencies or contract sold to the highest bidder. The following discussion of DPDO concerns only the handling and disposal of overage chemicals.

Chemical items within DoD are categorized into three classes by DPDO: (1) those for which DPDO will take both paper accountability and physical custody, (2) those for which DPDO will take paper accountability but not physical custody, and (3) those for which DPDO will accept neither paper accountability nor physical custody.

Most items fall into the first category and are stored by DPDO at either the South Depot Annex or the Camp Allen salvage yard. The DPDO property located at the South Depot Annex consists of warehouse and outside storage facilities, while the Camp Allen salvage yard consists of an open asphalt-paved area.

Currently, chemicals that fall into the first category are stored in the warehouses at the South Depot Annex. The chemicals are then recycled within DoD or other Federal agencies or taken by State agencies for use in school or university laboratories. These items could also be sold to chemical contractors for recovery.

Chemicals in the second category are designated by DPDO as hazardous and will not be physically accepted by DPDO. These items are listed in appendix E. DPDO does, however, accept paper accountability for these items and proceeds with processing, as described for category 1 chemicals above. These items are retained by the generator (e.g., NSC NORFOLK, PWC NORFOLK, etc.) until the paper work is completed by DPDO and the items are then transported off SPNC. Hazardous chemicals that are not contract sold are currently removed from SPNC by hazardous waste contractors and disposed of in EPA-approved disposal areas.

Items in the third category include classified chemicals and radioactive substances. Handling, storage, and disposal of radiological materials are addressed in section 6.3.6.

6.3.3 Pesticides

Pesticides (insecticides, herbicides, fungicides, and rodenticides) have been and are currently being used throughout SPNC to maintain grounds and structures and to prevent pest-related health problems. Pest control services offered at SPNC include the following: (1) household, structural, health-related, and nuisance insect and rodent control programs; (2) weed control programs at security fences, parking areas, railroad tracks, and utility sites; and (3) programs involving turf areas (e.g., golf course) and ornamental trees and shrubs. The storage, mixing, and application of pesticides at SPNC are undertaken at two locations. Pesticides for use over the majority of the base are currently stored and mixed under the direction of PWC NORFOLK. Pesticides used on the two golf courses are stored and mixed at Bldg. CA-500 and applied by golf course personnel working out of Bldg. CA-500.

All pesticides used by PWC NORFOLK (Bldg. Z-194) and their respective application rates are itemized monthly on DoD Form 1532. These records are on file on the second floor of Bldg. Z-140. Examination of these records did not indicate excessive usage of pesticides at SPNC. Pest control activities for the years 1978 through 1981 are summarized in Naval Energy and Environmental Support Activity (NEESA), Environmental Information Division (1982).

Pesticide chemical and application rates for the golf courses are recorded in logbooks. Concentrations are mixed according to directions on the chemical labels, and 100,000 square feet is sprayed with each application. The logbooks did not indicate any excessive use of pesticides.

Pesticides for use in areas other than the golf courses have been stored in Bldg. Z-194 since 1978. This building is equipped with a bermed storage area for these chemicals. Table 6.3-2 lists the chemicals currently stored in Bldg. Z-194.

Bldg. Z-194 is equipped with a separate formulation and mixing room. Sink and floor drains were connected to the sanitary sewer system leading to the HRSD STP in the late 1970s; prior to that, the drains emptied into a storm sewer leading to the Elizabeth River. An equipment rinse area with a bermed, concrete-lined surface is adjacent to Bldg. Z-194. The rinse area is reportedly connected to a holding tank. The volume of the holding tank is unknown, and there is no record of it being pumped out since 1978.

Between 1974 and 1977, Bldg. Z-93 was used as the pest control shop. Drains from the mixing area in Bldg. Z-93 discharged to the storm sewer and ultimately to the Elizabeth River. From the late 1960s to 1973, Bldg. V-95 was used as the pest control shop. During this period, the rinseates from sprayers, mix tanks, pesticide containers, and spray equipment drained to a french drain located outside Bldg. V-95 (site 5). The drain was constructed of a 10-foot section of culvert approximately 28 inches in diameter placed vertically in the ground and filled with gravel. Approximately 100 gallons per week of pesticide rinseates, as well as intermittent discharges of overage concentrated pesticides, was discharged either directly into the top of this culvert or from a sink located in Bldg. V-95 that drained into the culvert. Bldg. V-95 is no longer used as a pesticide shop, but this drain has not been closed. The french drain was inaccessible during the site visit due to equipment storage in the area. The types of chemicals used in this pest control shop included malathion, chlordane, and DDT.

From 1949 to the late 1960s, Bldg. NM-37 was used as a pest control shop. Records and visual inspection of this building did not reveal any problems regarding past disposal of pesticide wastes.

Pesticides used at the golf courses are stored in a separate locked, bermed concrete area of Bldg. CA-500. Table 6.3-3 lists the chemicals currently stored in Bldg. CA-500.

Mixing of pesticides for the golf courses has been performed in Bldg. CA-500 since 1977. The drain in the sink is connected to the sanitary sewer system leading to the HRSD STP. In the late 1950s, pesticide mixing took place in Bldg. CA-437. This building has been torn down, and the area is now a concrete-paved parking lot.

Table 6.3-2
Pesticide Storage in Bldg. Z-194

Pesticide	Quantity Stored
Malathion	Two 55-gallon drums
Diazinon	12 gallons
Hyvolex, solution	20 gallons
Hyvolex, powdered	250 pounds
Baygon	12 gallons
Chlordane	10 gallons
2,4-D	10 gallons

Source: ESE, 1982.

Table 6.3-3
Pesticide/Herbicide Storage in Bldg. CA-500

Pesticide/Herbicide	Quantity Stored (gallons)
Chipco	4
Diazinon	12
Daconate	20

Source: ESE, 1982.

Both the golf course pest control shop and the PWC NORFOLK pest control shop currently dispose of empty pesticides containers according to directions on the label (i.e., rinsing, punching with holes, and disposing of as ordinary solid wastes). This disposal method was reportedly also practiced in the past.

6.3.4 PCBs

Electrical equipment (transformers, rectifiers, capacitors) containing PCB (greater than 500 parts per million) and PCB-contaminated (50 to 500 parts per million) fluids have been used and are currently in use at SPNC. The locations of in-service and out-of-service PCB electrical items, as well as quantities of PCB fluids contained in the electrical items, are identified in the following paragraphs. In addition, the location of PCB-contaminated materials and the PCB concentration of these materials are identified.

6.3.4.1 In-Service Items

An inventory of electrical items containing PCB fluids was recently (20 Jan 1982) comleted for NAVAIREWORKFAC NORFOLK by the EPA Central Regional Laboratory (see appendix F). A total of 35 in-service items was identified as containing PCBs. Total weight of the in-service PCB fluid was estimated at 102,718 pounds (EPA Region III, Central Regional Laboratory, 1982). A similar inventory recently (31 Jul 1981) was completed at PWC NORFOLK. A total of 205 in-service transformers, with an estimated total fluid weight of 382,930 pounds, was identified as containing PCBs. In addition, 423 in-service capacitors containing 13,937 pounds of PCB-contaminated fluids were also present (PWC NORFOLK, 1981). It was reported that all in-service electrical items containing PCBs have been labeled according to EPA regulations (EPA, 1981b). The PWC NORFOLK inventory (PWC NORFOLK, 1981) noted leaks in some of the transformers inventoried in July 1981. At the time of the site visit, several transformers that had been reported as having leaks were surveyed. All were in locked areas with plastic bags covering the region of the transformer where the leak had been detected. Of those surveyed, none were currently leaking.

Although the two above-mentioned inventories include the majority of electrical items containing PCB fluids, the two combined inventories reportedly do not represent a complete inventory for the entire SPNC.

6.3.4.2 Out-of-Service Items

Currently, DPDO maintains paper accountability for all out-of-service PCB electrical items but does not receive physical custody of these items because of the lack of a proper storage facility, as required by EPA (1981b). Currently, the two main areas for out-of-service PCB storage are Bldg. W-318, under the control of NSC

NORFOLK, and cell 4 of Bldg. SDA-215, under the control of PWC NORFOLK. Both buildings have concrete floors, and the storage areas are bermed.

At the time of the NAVAIREWORKFAC NORFOLK survey, 13 out-of-service transformers with 681 gallons of PCB-containing oil and 33 drums of PCB-contaminated materials were being stored for disposal in Bldg. X-318. Table 6.3-4 lists the out-of-service electrical items stored in Bldg. X-318 and the quantity of PCB fluid contained in each item. Table 6.3-5 lists the drums of PCB-contaminated material stored in Bldg. X-318 and the PCB concentrations of the contaminated materials.

Out-of-service electrical items containing PCBs have been stored awaiting disposal since 1978. Currently, DLA is soliciting bids for offsite disposal of these items. In 1978, Bldg. X-318 was modified for the storage of PCB-containing transformers. Modifications included an impermeable concrete floor that is bermed and without drainage. The entire building and yard are enclosed in a fence, and access is restricted. Since 1978, out-of-service transformers have been transferred to Bldg. X-318. If the fluid is known to contain PCBs at greater than 500 parts per million, the transformer is stored inside Bldg. X-318. If the fluid is less than 500 parts per million PCBs, the transformer is stored in the enclosed yard outside Bldg. X-318. Out-of-service transformers with unknown PCB content are subjected to analysis by a contract laboratory and are subsequently stored in either the yard next to or in Bldg. X-318, depending upon the analytical results. The PWC NORFOLK survey listed 8 transformers with approximately 46,000 pounds of PCB-containing oil and 33 drums with PCB-contaminated material that were awaiting disposal. These 33 drums were also included in the NAVAIREWORKFAC NORFOLK survey.

PWC NORFOLK currently is storing PCB-contaminated materials in cell 4 of Bldg. SDA-215. The materials are in fifty 55-gallon drums awaiting removal by a DPDO hazardous waste contractor. The storage area in cell 4 is bermed, labeled as PCB storage, and access is restricted.

6.3.4.3 Spills

From the 1940s to 1978, both in-service and out-of-service transformers were stored in an enclosed area behind Bldg. P-71 (site 4). In addition, a drum of PCB-containing transformer fluid, which was used for topping off any leaking transformers, was stored in Bldg. P-74 (behind Bldg. P-71). During the interval from the 1940s to 1978, the fluid in out-of-service transformers that had developed leaks was often poured on the ground in the yard behind Bldg. P-71 (site 4) prior to shipment to salvage. It was also reported that transformer oil was occasionally used to control weeds by direct application at various electrical substations.

The outer area around the yard behind Bldg. P-71 showed evidence (dark stains on the soil surface) of past oil spills, possibly

Table 6.3-4
Out-of-Service PCB-Containing Transformers Currently Stored in Bldg. X-318

Identification Number	Quantity of PCB Material
NAVAIREWORKFAC NORFOLK	gallons
1280-6661	100
1280-6662	250
1280-6663	115
1280-6664	14
1280-6664	14
1280-6664	14
1280-6665	35
1280-6665	35
1280-6665	35
1280-6666	5
6808935	16
6808934	16
7147954	32
PWC NORFOLK	pounds
0222-6661	3,445
0222-6662	4,171
0222-6663	9,438
0221-6696	6,349
0221-6692	7,986
0221-6698	7,308
0221-6699	3,929
0221-6694	3,445

Sources: EPA Region III, Central Regional Laboratory, 1982.
PWC NORFOLK, 1981.

Table 6.3-5
Drums of PCB Materials Currently Stored in Bldg. X-318

Identification Number	Concentration of PCBs*
NAVAIREWORKFAC NORFOLK/PWC NORFOLK	
0221-6661	--
0221-6662	100 percent
0221-6663	100 percent
0221-6664	100 percent
0221-6665	742
0221-6666	221
0221-6667	194
0221-6668	--
0221-6669	--
0221-6670	--
0221-6671	--
0221-6672	--
0221-6673	--
0221-6674	316
0221-6675	384
0221-6676	184
0221-6677	--
0221-6678	--
0221-6679	100 percent
0221-6680	100 percent
0221-6681	219
0221-6682†	--
0221-6683†	--
0221-6684	100 percent
0221-6685	461
0221-6686	--
0221-6687	550
0221-6688	1,335
0221-3389	192
0221-6690	284
0221-6691	176
0221-6692	1,818
0221-6693	486
0221-6695	2,375
0240-6661	--

* Concentration in parts per million (ppm) unless otherwise indicated.
† Combined with other material.
-- Drums are currently undergoing PCB-content analysis.

Sources: EPA Region III, Central Regional Laboratory, 198 PWC NORFOLK, 1981.

from the draining of the fluids from electrical equipment. Due to the intermittent drainage of fluids and the unknown concentrations of PCBs, it is not possible to estimate the total amount of PCBs potentially released to the soils in this area. Much of the yard has subsequently been covered with gravel.

6.3.5 Firing Ranges and Ordnance

No records were found indicating the presence of major firing ranges at SPNC either currently or in the past.

The NM area, located in the southeastern portion of SPNC, has been used for the storage of ordnance since the 1940s. No problems regarding the disposal of ordnance materials were reported at SPNC.

6.3.6 Radiological Materials

Currently, the storage and handling of stock items of radiological materials (other than nuclear propulsion or nuclear weapons systems, which are outside the scope of this assessment) are under the control of the NSC NORFOLK RSO. Radiological materials and wastes are stored in a secured area on the third floor of Bldg. Z-103, a limited access building. The area has appropriate security and warnings signs. Personnel in the area are required to wear monitoring badges, and the area is surveyed for excess radiation on a regular basis. Materials stored in the radiation area of Bldg. Z-103 at the time of the site visit are listed in NSC NORFOLK (1981c).

NSC NORFOLK currently has paper accountability for the disposal of these low-level radiological materials. These materials are demilitarized, packed in polybags, and sealed in drums, at which time they are certified as radioactive waste. The packaged materials undergo a radiation survey and a swipe test and are then removed by a contractor (usually Chem Nuclear of Barnwell, S.C.). This current system has been in operation approximately 5 years. In the past, the system was less organized and was not subjected to the monitoring that is currently required.

The only area associated with some past radiological waste problems was the instrument repair shop in Bldg. V-60 (site 11). This shop was opened in the late 1940s and operated in Bldg. V-60 until 1956. In 1956, the shop was moved to its current location in Bldg. LF-18. Radiological materials were never used at Bldg. LF-18 but were used extensively at Bldg. V-60. While in Bldg. V-60, unknown quantities of radium wastes from ships dials were poured down the sink drains, contaminating the drain pipes and traps. These sinks were connected to the storm drain, which ultimately discharged to Willoughby Bay. After the instrument repair shop moved to Bldg. LF-18, the drain traps in Bldg. V-60 were plugged with concrete. In May 1982, Chem Nuclear of Barnwell, S.C., was awarded a contract to clean up the contamination in the drain pipes and traps in Bldg. V-60. The cleanup procedure has been completed.

6.4 WASTE TREATMENT AND DISPOSAL

This section presents a brief historical overview of liquid waste treatment and disposal, as well as solid waste disposal. Liquid wastes include sanitary wastewater, stormwater drainage, industrial wastewater, and other liquid industrial wastes. Solid wastes include ordinary solid wastes, such as garbage and office waste, industrial sludges, scrap metal, and constructon and demolition debris. In addition, specific areas of potential contamination consisting of waste storage, disposal, and/or spill sites are described.

6.4.1 Liquid Waste Treatment and Disposal

6.4.1.1 Sanitary Wastewater

Since 1946, sanitary wastewater has been collected and routed to the HRSD STP utilizing a sanitary sewer system. Currently, over 4 million gallons per day is conveyed to the HRSD STP. Prior to 1946, septic tank systems, as well as combined (stormwater and sanitary wastewater) sewer systems leading to the Elizabeth River or Willoughby Bay, were used for the disposal of sanitary wastewater. Since the HRSD STP began operations in 1946, most of the previously used septic tank systems have been abandoned, and drains leading to the septic tanks or the combined sewer systems have been rerouted to the sanitary sewer system. Although 23 septic tanks were reportedly still in use in 1976 (LANTNAVFACENGCOM, 1979b), none were likely to have been receiving significant quantities of wastewater.

For about the last 10 years, the sanitary sewer system has been receiving ship-to-shore discharges. In addition to these discharges, the sanitary sewer system also receives inflows from a number of industrial and laboratory operations. The predominant inflow is the IWTP effluent, which averages about 100,000 gallons per day. Other sources of industrial and laboratory wastewaters include vehicle wash racks, wet curtain spray paint booths, photograph and X-ray developing, and laboratory sink drains. However, these sources of flow are minor in comparison to the IWTP effluent.

It is estimated that over 25 percent of the total flow conveyed from SPNC to the HRSD STP consists of ship-to-shore and industrial and laboratory discharges. Industrial wastewater treatment and disposal are discussed further in section 6.4.1.3.

It was reported that the wastewater flow contribution from SPNC to the HRSD STP has caused occasional operational problems at the HRSD STP since it was constructed in 1946. These problems resulted from such occurrences as discharges of significant quantities of oil to the sanitary sewer at SPNC.

6.4.1.2 Stormwater Drainage

Surface water runoff originating at SPNC is transmitted to adjacent surface waters through a system of underground pipes and culverts and open ditches (see figure 6.4-1). There are currently no major industrial or sanitary discharges to the storm drainage system, which includes over 90 outfalls discharging to Willoughby Bay, Mason Creek, and the Elizabeth River. As shown in figure 6.4-1, the eastern areas of SPNC, including the NM area, drain into Mason Creek, then northward to Willoughby Bay through a large culvert. Much of the central portion of SPNC, including the Camp Allen and CD areas, also drain to Willoughby Bay via drainage ditches and a large culvert. The remaining areas drain essentially directly to the nearest surface water, either the Elizabeth River or Willoughby Bay.

Historically, the storm drains at SPNC have been used to dispose of a wide variety of industrial liquid wastes. Disposal of these liquid wastes to the storm drains was standard practice at SPNC prior to the early to mid-1970s, when various steps were taken to eliminate significant quantities of industrial waste from reaching surface waters from stormwater outfalls.

The most severe and well documented stormwater problems at SPNC were related to a group of outfalls discharging industrial wastes generated by NAVAIREWORKFAC NORFOLK to Willoughby Bay. NAVAIREWORKFAC NORFOLK generates large quantities of metals plating, parts cleaning, and paint stripping waste, which were known to be contributing a wide range of pollutants, primarily several metals, to the bay in the past. This situation and the steps taken to correct it are discussed further in section 6.4.1.3.

Much of the land on which SPNC facilities are now built was covered with water before 1940. Extensive dredge and fill operations conducted between 1940 and 1950 filled much of Mason Creek and associated wetlands in the central portion of SPNC for construction of NAVAIREWORKFAC NORFOLK and NAS NORFOLK facilities. Filling was also used to reclaim the area north of pier 10 in the northwestern portion of SPNC. These operations significantly altered natural surface drainage patterns in the area.

6.4.1.3 Industrial Wastewater

The predominant industrial wastewaters, regarding both volume and strength, are generated by NAVAIREWORKFAC NORFOLK operations, including metals plating, parts cleaning, and paint stripping. Other relatively minor sources of wastewater include vehicle wash racks, wet curtain spray paint booths, and photographic and X-ray developing operations.

Prior to the early 1970s, many industrial wastewaters were discharged to the storm sewer system and ultimately to the Elizabeth

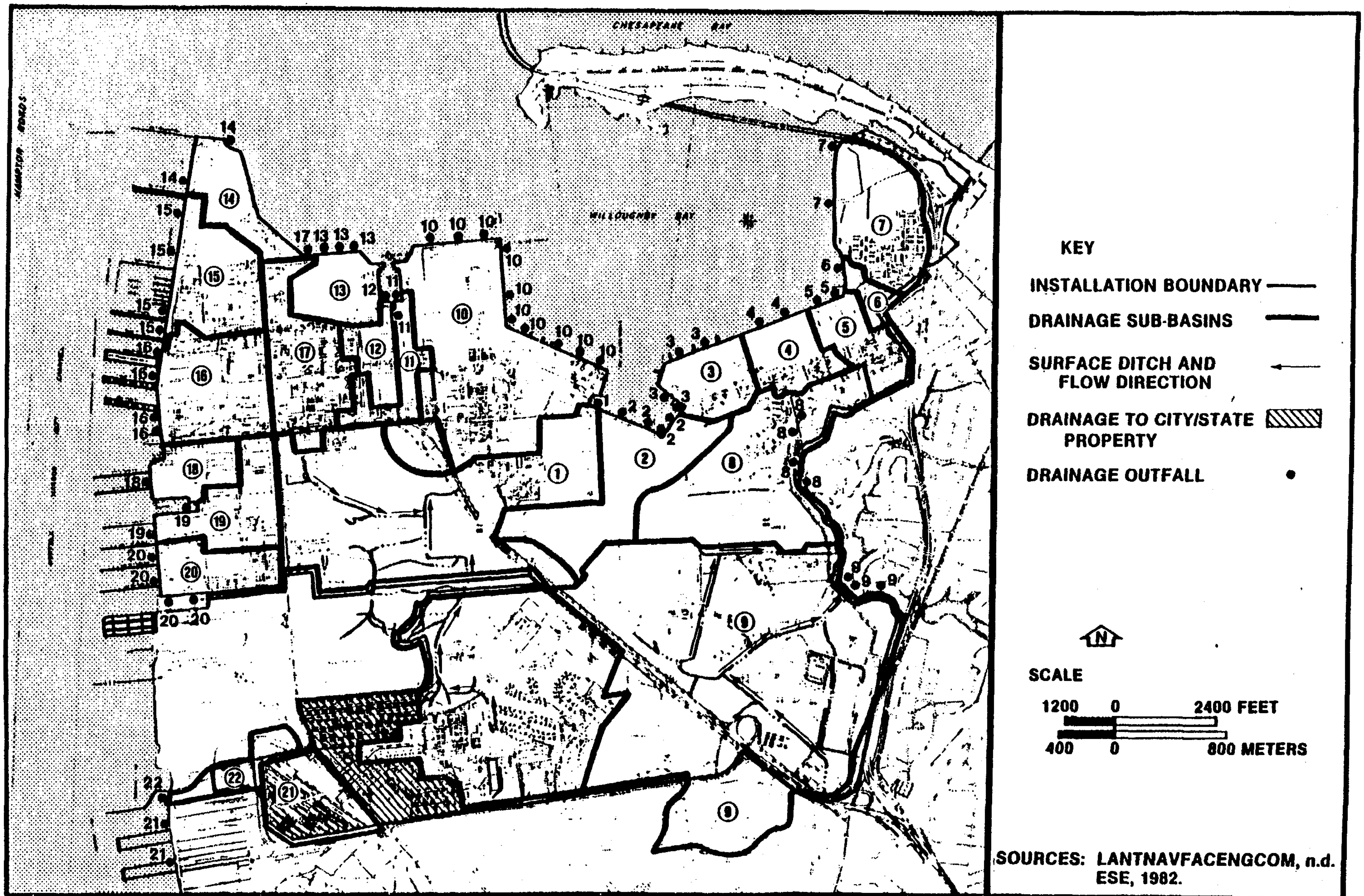


Figure 6.4-1
STORM DRAINAGE SYSTEM

INITIAL ASSESSMENT STUDY
SEWELLS POINT
NAVAL COMPLEX

River and Willoughby Bay. It was reported that, in early 1970, EPA (then known as the Federal Water Pollution Control Administration) conducted a study of wastewater generation and disposal in the NAVAIREWORKFAC NORFOLK area.

The study concluded that discharges of industrial wastewaters generated by NAVAIREWORKFAC NORFOLK operations to Willoughby Bay via the storm sewer system was a source of metals pollution to the bay (primarily chromium, cadmium, and zinc), cyanide, oil and grease, and phenols (Wiley and Wilson, 1971). Consequently, a pollution control program was initiated to develop more environmentally sound practices for disposing of industrial wastewaters generated at SPNC. In general, this program involved segregation of industrial wastewaters and providing pretreatment prior to discharge to the sanitary sewer system, rather than the storm sewer system.

The waste segregation program in the NAVAIREWORKFAC NORFOLK area involved characterizing the various waste streams to determine those which were amenable to pretreatment. Subsequently, numerous waste streams amenable to pretreatment (which mainly consist of metals plating rinse waters and paint stripping wastewater) were routed to the IWTP, which was constructed to serve as a centralized pretreatment facility. Liquid wastes that are not amenable to pretreatment primarily consist of metals plating solutions, water-based cleaning solutions, and various organic solvents. Disposal of these wastes is discussed in section 6.4.1.4, Other Industrial Wastes.

Virtually all of the industrial waste streams in the NAVAIREWORKFAC NORFOLK area had been routed to the IWTP by the time it began operation in 1976. Although persistent violations of the NPDES permit limitations for the stormwater outfalls in the NAVAIREWORKFAC NORFOLK area continue to occur, they are attributed to stormwater runoff from the industrial NAVAIREWORKFAC NORFOLK area, rather than to discharges of industrial wastewater to the storm sewer. The permit limitations for cadmium, zinc, and oil and grease are those which are most frequently violated. The NPDES permit (NPDES permit No. VA0004413) covers nine stormwater outfalls in the NAVAIREWORKFAC NORFOLK area.

The wastewaters routed to the IWTP are segregated into two separate waste streams, a cyanide waste stream and a chromium/phenolic waste stream, for subsequent split treatment. Chlorination and pH adjustment of the cyanide waste stream removes the cyanide, and pH adjustment and the addition of sulfur dioxide to the chromium/phenolic waste stream reduces hexavalent chromium to trivalent chromium. Following this split treatment, the two waste streams are combined to form a mixed chemical waste stream for additional treatment provided to remove metals and phenolic compounds. Additional treatment consists of pH adjustment, clarification, addition of hydrogen peroxide, and activated carbon adsorption. The plant operates on a batch basis with an average discharge of about 100,000 gallons per day (LANTNAVFACENGCOM, 1979d; Associated Water and Air Resources Engineers, Inc., 1977).

Although the IWTP has experienced many operational problems since it began operations in 1976, it has been in compliance with discharge requirements since 1978. Recently completed modifications have significantly reduced operation and maintenance costs and improved reliability.

As previously mentioned, industrial wastewaters generated at SPNC, other than those generated to NAVAIREWORKFAC NORFOLK operations, include vehicle wash rack wastewater, wastewater from wet curtain spray paint booths, and waste photographic and X-ray developing solutions. Vehicle wash rack wastewater generally has been discharged to the storm sewer system and ultimately to Willoughby Bay in the past. However, most wash rack drains were connected to the sanitary sewer system within the last few years. In general, paint booth wastewater and spent photographic and X-ray developing solutions historically have been discharged to the sanitary sewer system. Those drains which previously conveyed paint booth wastewater and spent developing solutions to the storm sewer system have been connected to the sanitary sewer system within the last 5 to 10 years.

The industrial wastewaters described in the preceding paragraphs are minor in comparison to the IWTP effluent and constitute a total combined flow of less than 15,000 gallons per day.

6.4.1.4 Other Industrial Wastes

Other industrial wastes generated at SPNC consist of waste oils and hydraulic fluids, various organic solvents, metals plating solutions, and sludges from metals plating and paint stripping operations, as well as that produced by the treatment of wastewater at the IWTP.

Waste oils and hydraulic fluids have been collected at the point of generation in bowsers or oil-water separators. PWC NORFOLK oil recovery personnel periodically pump these wastes out of the bowsers and separators and transport them to SWOBs moored at the piers on the western shore of SPNC. The SWOBs then haul the waste oils and hydraulic fluids to the NSC-CI waste oil reclamation facility.

Prior to the early to mid-1970s, various organic solvents and metal plating solutions, primarily generated by NAVAIREWORKFAC NORFOLK operations, were generally discharged to the storm sewer system and ultimately to Willoughby Bay. As a result of the waste segregation program initiated in the early 1970s, the drumming and stockpiling of these wastes began. The drumming and stockpiling of metals plating, parts cleaning, and paint stripping sludges, which had previously been hauled to the Camp Allen landfill (site 1), also began in the early to mid-1970s. The drummed waste was stockpiled along the seawall near Bldg. V-88 until 1975. At that time, the drums were moved to the area east of the large metal storage building, known as the Taussig cans, in the NM area. The detection of past leakage and intentional spillage of wastes on the ground surface in this area in 1979 prompted the development of an improved hazardous waste management plan, which was implemented that same year. This plan involves the temporary storage of hazardous materials in two main areas, a drum storage yard near Bldg. LF-18 and cells 1 through 4 of Bldg. SDA-215, prior to disposal by contract hauling offsite to EPA-approved disposal facilities. The drum storage yard near Bldg. LF-18, is used for the storage of wastes generated by NAVAIREWORKFAC NORFOLK, whereas Bldg. SDA-215 is used for the storage of hazardous wastes generated by other activities at SPNC.

6.4.2 Solid Waste Disposal

Historically, all solid waste generated on SPNC has been disposed of onsite. Prior to the opening of the Camp Allen landfill (site 1) in the early 1940s, solid waste was disposed of in a landfill located in the general area of gate 3. This landfill was operated as a burning dump with all combustible wastes burned in the landfill, and it is unlikely that significant quantities of hazardous waste were disposed of in this landfill. No other information was available concerning the operation or extent of this landfill.

The Camp Allen landfill (site 1) was used for the disposal of wastes generated at SPNC from the early 1940s until about 1974. These wastes included garbage, office waste, construction debris, coal fly ash and bottom ash, industrial sludges and solvents, and overage chemicals.

In 1967, construction of the salvage fuel boiler (Bldg. Z-309) at SPNC was completed. This boiler was used to generate steam from the combustion of solid waste. The salvage fuel boiler became fully operational in 1970, and, since then, all combustible nonhazardous wastes have been burned as fuel. Ash from the salvage fuel boiler was landfilled first at Camp Allen and then (after 1974) at the CD area landfill (site 6).

From 1974 through the present, PWC NORFOLK has operated a construction debris landfill in the CD area located in the west-central portion of SPNC. This fill is operated by the area method and accepts only nonputrescible, nonhazardous materials, mostly construction-demolition debris and ash from the salvage fuel boiler (Bldg. Z-309) and the power plant (Bldg. P-1). However, a maximum of 1,500 cubic yards of cadmium dust from a NAVAIREWORKFAC NORFOLK sandblasting operation has also been disposed of at this site.

Another construction debris landfill was operated at SPNC during the period 1974 to 1978. This landfill was located on the extreme northwestern end of SPNC in the Q area (site 9). Only construction debris was landfilled at this site.

6.4.3 Waste Disposal Site Characteristics

During the onsite assessment, 18 past or current waste storage/ disposal/spill sites were identified at SPNC (see figure 6.4-2). The

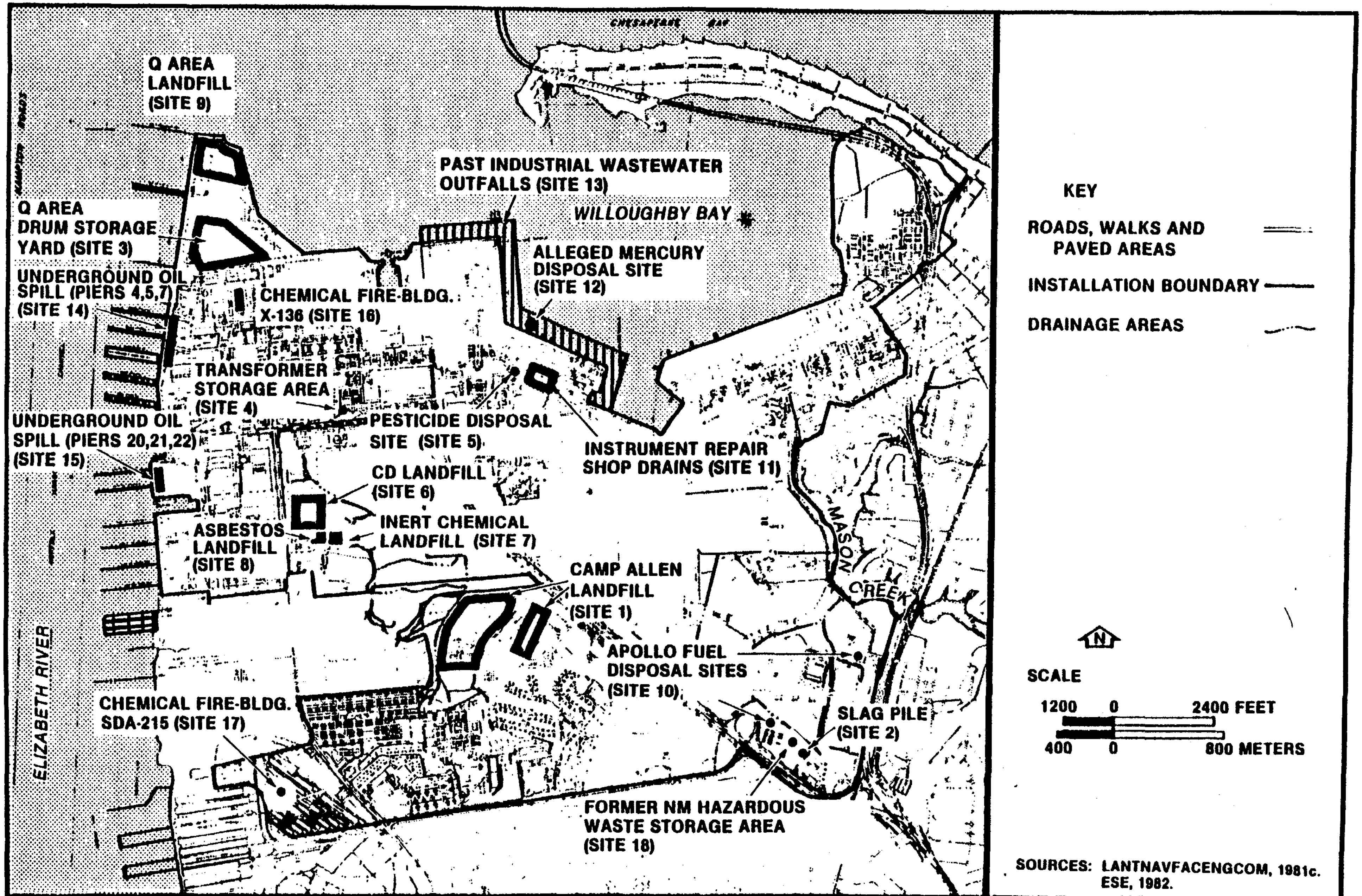


Figure 6.4-2
MAP OF POTENTIAL CONTAMINATION SITES

INITIAL ASSESSMENT STUDY SEWELLS POINT NAVAL COMPLEX

characteristics of each of these 18 sites are described in detail in the following sections.

6.4.3.1 Camp Allen Landfill (Site 1)

The Camp Allen landfill (site 1) was used for the disposal of wastes generated at SPNC from the early 1940s until about 1974. In addition, small quantities of inert solid waste were hauled to this landfill from NSC-CI from 1963 until 1970. Figure 6.4-3 shows the location of the Camp Allen landfill (site 1), which consists of an eastern and western portion. The eastern portion received wastes from a salvage yard fire (see discussion below), whereas other wastes described herein were disposed of in the western portion.

Prior to the landfilling activities, the Camp Allen area was utilized as a source of borrow material. In the mid-1940s, an incinerator was constructed just south of the current location of the brig (Bldg. CA-484) to burn combustible wastes. This incinerator operated until the mid-1960s. Materials too bulky for the incinerator were burned in the landfill. Ash from the incineration of solid wastes, as well as fly and bottom ash from the power plant (Bldg. P-1), was also landfilled. In addition to these wastes, metals plating, parts cleaning and paint stripping sludges, overage chemicals, various chlorinated organic solvents, acids, caustics, paints, paint thinners, pesticides, asbestos, scrap metal, and construction and demolition debris were disposed of in this landfill. Many of these wastes were hauled from the Camp Allen salvage yard located next to the landfill. PWC NORFOLK, which operated the landfill, also operated the salvage yard until it was taken over by DPDO in 1973.

Information was not available regarding waste quantities for most of the toxic or hazardous wastes disposed of in the Camp Allen landfill (site 1) because of the intermittent nature of the disposal operations and the lack of operational records. However, based on industrial waste generation rates, it is estimated that approximately 40,000 pounds of metals plating sludge, 60,000 pounds of parts cleaning sludge, and 400,000 pounds of paint stripping residue have been disposed of in the Camp Allen landfill (site 1).

In 1971, a fire occurred in the northern portion of the salvage yard where waste lubricating oil, organic solvents, paints, paint thinners, acids, caustics, and pesticides were stored pending disposal. The fire reportedly was caused by incompatible chemical storage. The burned and, reportedly, smoldering residue from the fire, as well as the materials mentioned previously, were buried in the eastern portion of the landfill in the area just east and northeast of the salvage yard (see figure 6.4-3). This operation was a trench-type landfill. The trenches were reportedly about 150 feet long, 6 to 8 feet deep, and 10 feet wide.

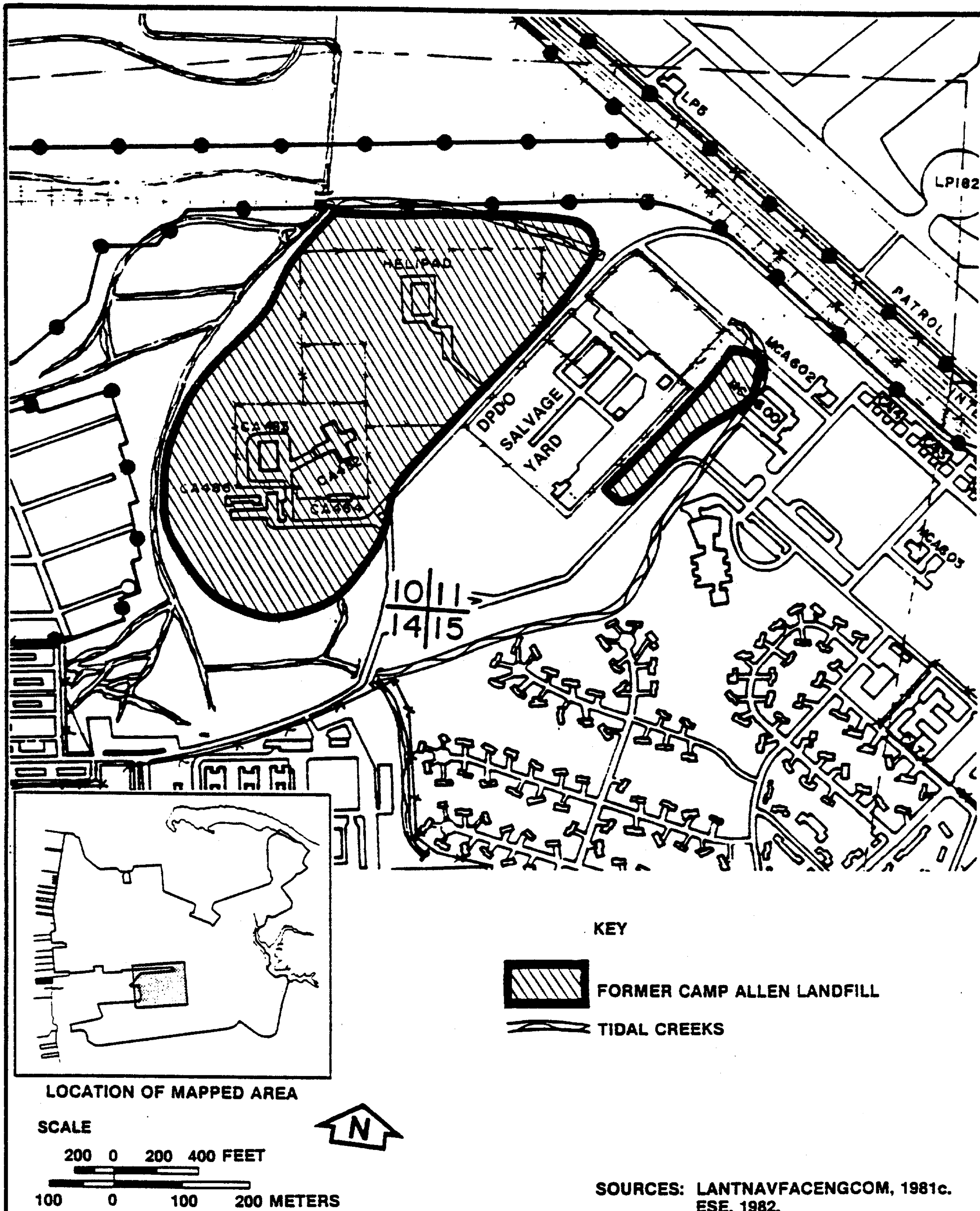


Figure 6.4-3
LOCATION OF THE CAMP ALLEN LANDFILL (SITE 1)

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The Camp Allen landfill (site 1), including the burial site of wastes from the salvage yard fire mentioned above, encompasses an area of approximately 45 acres. The majority of the site is currently covered with grass, and the brig (Bldg. CA-484) and a heliport have been constructed over the western portion of the landfill. The landfill is rimmed with tidal drainage ditches, which convey stormwater runoff from the area.

6.4.3.2 Slag Pile (Site 2)

The location of the slag pile (site 2) is shown in figure 6.4-4. The slag, which covers an area of approximately 2 acres, was generated by an aluminum smelting operation conducted in the 1950s and 1960s. The slag pile consists of pieces of various kinds of metal, primarily steel.

Stormwater drainage from the slag pile (site 2) flows northward to a creek canal (see figure 6.4-4). This creek discharges to Mason Creek, which flows into Willoughby Bay.

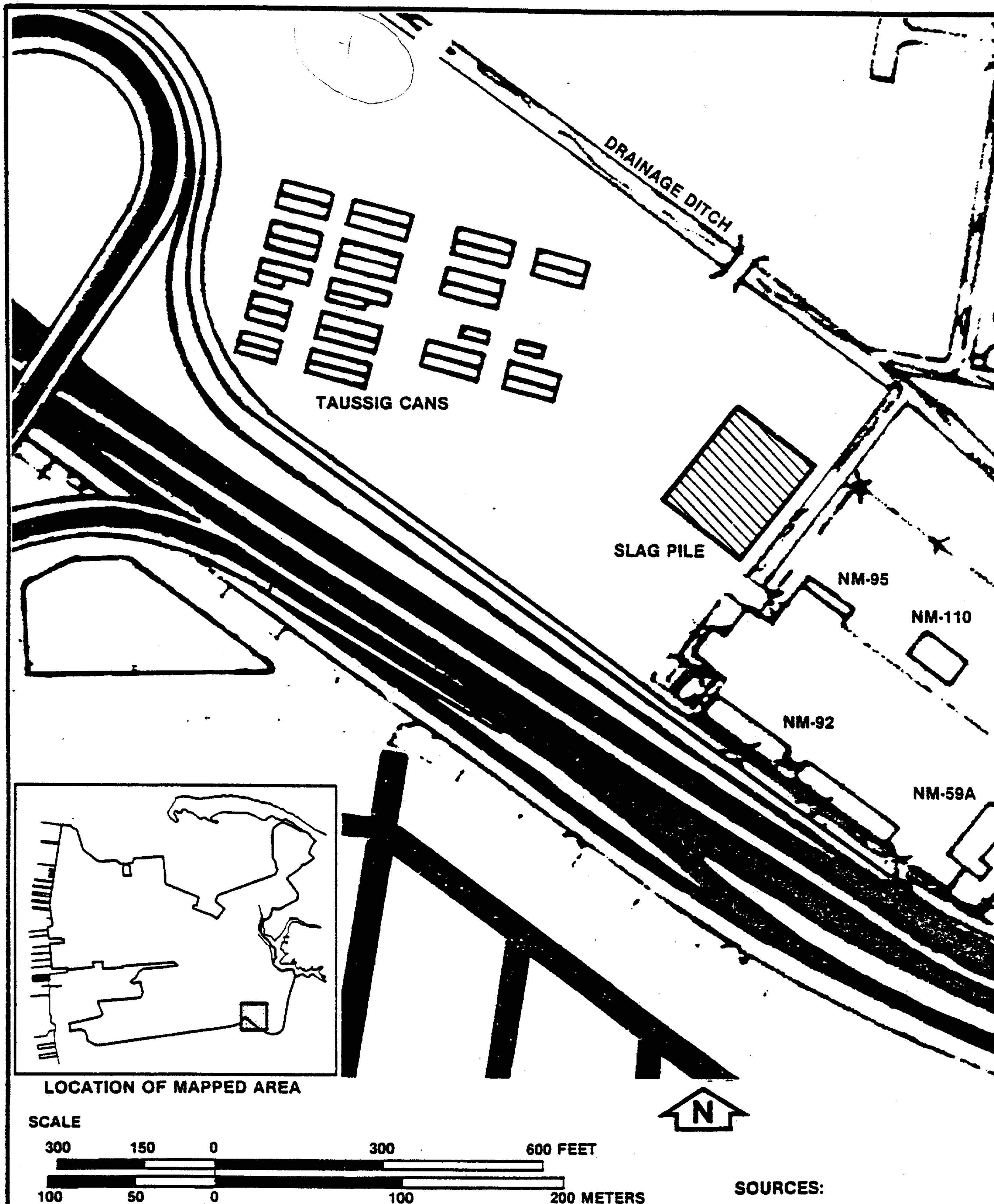
6.4.3.3 Q Area Drum Storage Yard (Site 3)

The Q area drum storage yard is an open earthen yard located in the northwestern corner of SPNC (see figure 6.4-5). This area was created by a fill operation conducted in the early 1950s and has been in use since then to store tens of thousands of drums. The drums contain mostly new petroleum products, various chlorinated organic solvents, and paint thinners. However, drums containing other chemicals, including formaldehyde and pesticides, were observed in this area during the onsite IAS survey. Numerous leaking drums were found throughout the storage yard, as well as evidence of past spillage (dark stains on soil). As shown in figure 6.4-5, the northern portion of the yard is used for storing damaged and leaking drums. As many as 50 drums were being stored in this area during the onsite IAS survey, and the soil in this area was thoroughly saturated with what appeared to be lubricating oil.

Stormwater drainage from the Q area drum storage yard (site 3) flows into the Elizabeth River and Willoughby Bay.

6.4.3.4 Transformer Storage Area (Site 4)

The transformer storage area behind Bldg. P-71 (see figure 6.4-6) was used to store out-of-service and new transformers from the 1940s until 1978. Transformer oil was reportedly drained from out-of-sevice transformers onto the ground surface in this area. Although much of the area is currently covered with recently laid gravel, the soil in the lowest part of the grade in the storage area is visible and exhibits dark stains, which is evidence of past spillage. Stormwater drainage from this site flows to Willoughby Bay.



SOURCES:
LANTNAVFACENGCOM, 1981c.
ESE, 1982.

Figure 6.4-4
LOCATION OF THE SLAG PILE
(SITE 2)

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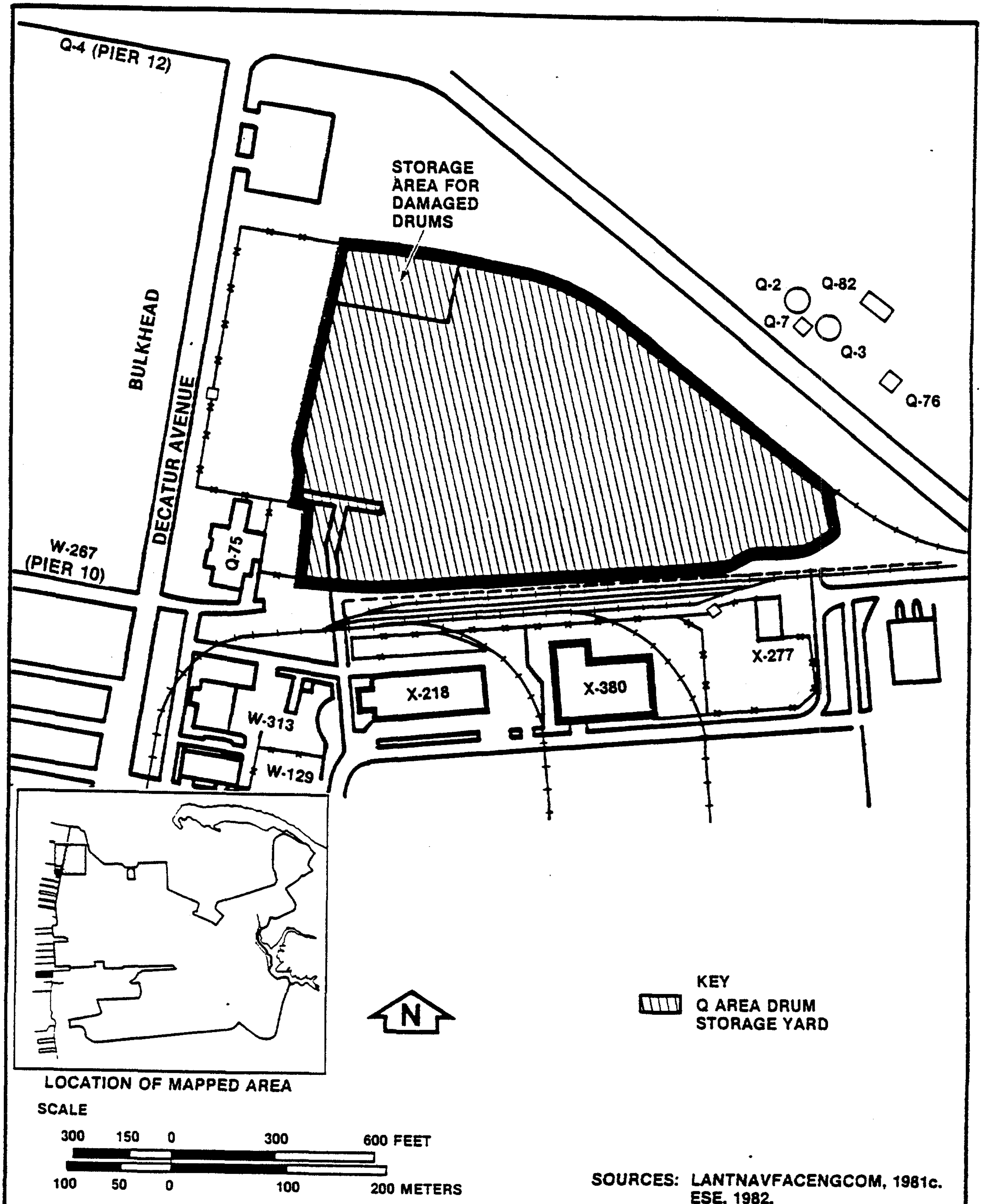

Figure 6.4-5
LOCATION OF THE Q AREA DRUM STORAGE YARD (SITE 3)

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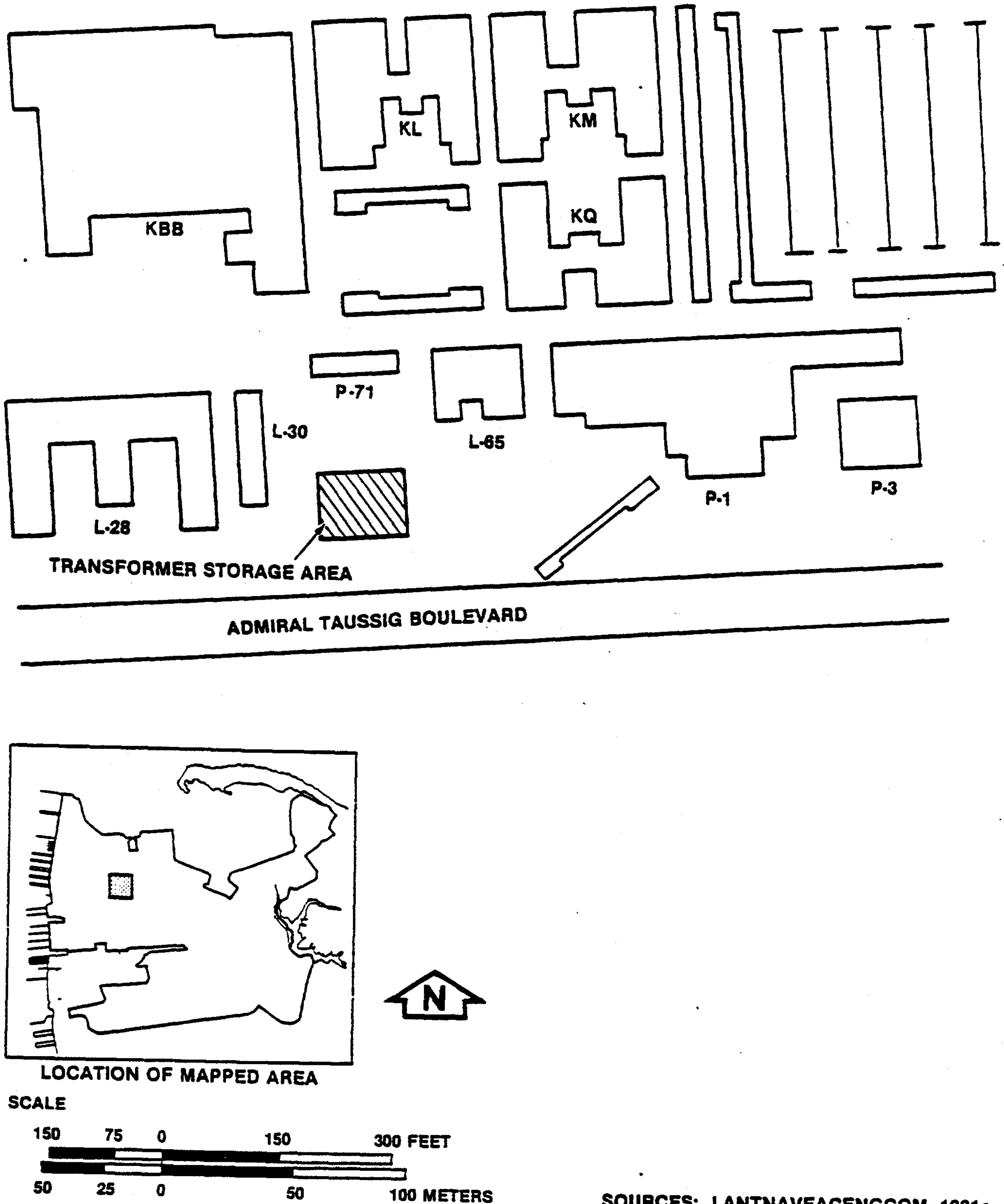

SOURCES: LANTNAVFACENGCOM, 1981c.
ESE, 1982.

Figure 6.4-6
LOCATION OF THE TRANSFORMER STORAGE AREA (SITE 4)

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6.4.3.5 Pesticide Disposal Site (Site 5)

The pesticide disposal site (site 5) consists of a french drain located southeast of Bldg. V-95 (see figure 6.4-7). This french drain, which consists of a 28-inch diameter culvert placed vertically into a gravel-filled hole in the ground, was used for the disposal of pesticide waste generated in the former pest control shop (Bldg. V-95). This shop was in operation from the late 1960s until 1973, and the french drain has not been used for pesticide disposal since 1973. It was reported that approximately 100 gallons per week of pesticide rinse water was disposed of in this french drain, as well as intermittent discharges of overage concentrated pesticides. Pesticides used in this pest control shop included chlordane, malathion, and DDT.

6.4.3.6 CD Landfill (Site 6)

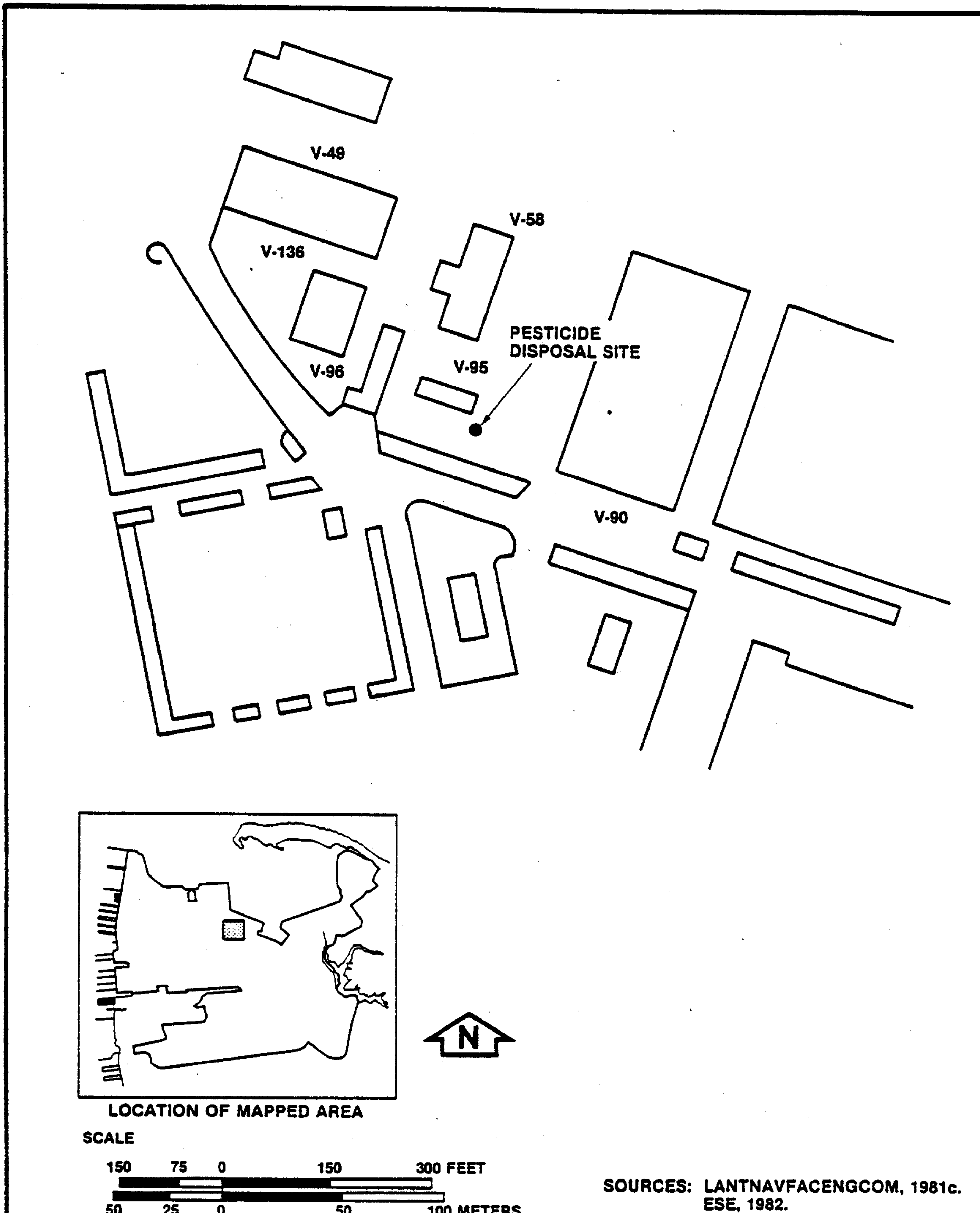
The CD landfill (site 6) has been used for the disposal of mainly nonputrescible, nonhazardous materials since 1974, and, in 1979, a landfill permit was obtained from the Virginia State Department of Health (SDH) for the disposal of inert wastes at this site. Mostly construction and disposal debris and ash from the salvage fuel boiler (Bldg. Z-309) and power plant (Bldg. P-1) at SPNC have been disposed of in this landfill. However, a maximum of about 1,500 cubic yards of cadmium dust from a NAVAIREWORKFAC NORFOLK sandblasting operation have also been disposed of at this site from 1974 to 1981. The dust was subjected to the EPA EP toxicity test (EPA, 1981a) and was found to exceed the maximum contaminant level for cadmium. Consequently, the dust is classified as a hazardous waste and is currently disposed of offsite at an EPA-approved hazardous waste disposal facility. Figure 6.4-8 shows the location of the CD landfill (site 6).

6.4.3.7 Inert Chemical Landfill (Site 7)

The inert chemical landfill (site 7), which is located south of the CD landfill (site 6), was used for a single disposal of overage inert chemicals, primarily unused ion exchange resins. Eighty-four pallets of chemicals were buried in this landfill on 25 Jun 1979, with the approval of the Solid and Hazardous Waste Management Division, Virginia SDH. This landfill was constructed with a 1-foot clay base and 6-foot clay side berms. The final landfill cover consists of 2 feet of soil capped with 1 foot of clay (LANTNAVFACENGCOM, 1979a).

6.4.3.8 Asbestos Landfill (Site 8)

The asbestos landfill (site 8), which is located just east of the inert chemical landfill (site 7), was used for the single disposal of asbestos generated during a ship refitting operation. Six thousand five hundred bags (double bagged) of asbestos were buried at this site on 27 Jun 1979, with the approval of the Solid and Hazardous Waste Management Division, Virginia SDH. This landfill was constructed



SOURCES: LANTNAVFACENGCOM, 1981c.
ESE, 1982.

Figure 6.4-7
LOCATION OF THE PESTICIDE DISPOSAL SITE (SITE 5)

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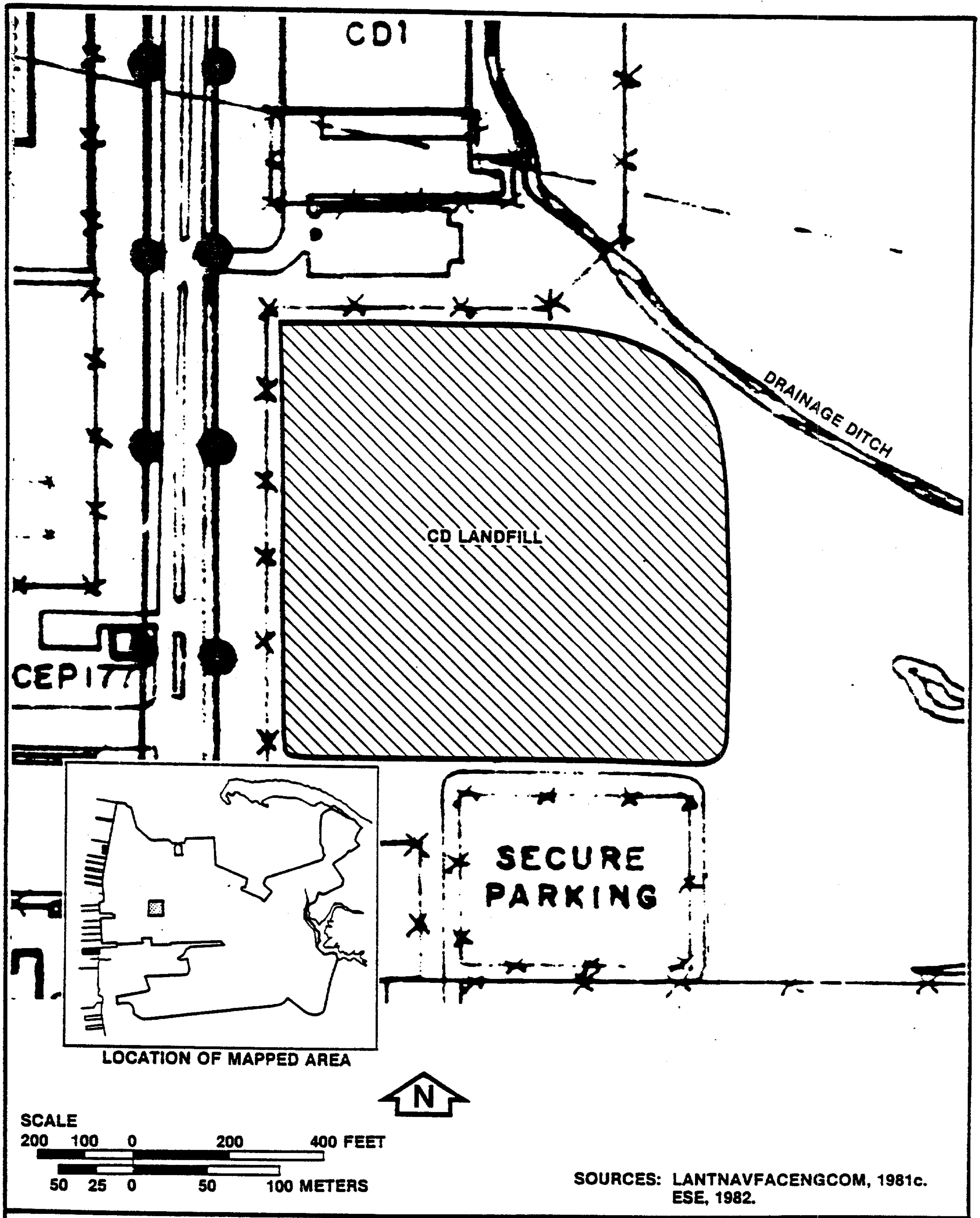

Figure 6.4-8
LOCATION OF THE CD LANDFILL (SITE 6)

INITIAL ASSESSMENT STUDY
SEWELLS POINT
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similarly to the inert chemical landfill (site 7) (LANTNAVFACENGCOM, 1979a).

6.4.3.9 Q Area Landfill (Site 9)

The Q area landfill (site 9) is located on the extreme northwestern end of SPNC, which was formed during a past fill operation. This landfill, which was operated from 1974 until 1978, was used for the disposal of only construction debris.

6.4.3.10 Apollo Fuel Disposal Sites (Site 10)

During the period 1967 to 1969, two or three Apollo spacecraft capsules were offloaded from aircraft carriers at SPNC. A remaining fuel component, monomethylhydrazine, was drained from the capsules into 55-gallon drums for subsequent disposal. It was reported that three or four drums of the fuel component were drained from each capsule and that the fuel was disposed of by pouring it onto the ground surface, allowing it to percolate into the soil. There were two disposal sites, both of which were located in the NM area. The first site was located north of the Taussig can area and consisted of a fenced area about 40 feet long and 20 feet wide. Three or four drums of the fuel component were disposed of at this site, and one or two disposals were conducted at this site before it was abandoned. The site was abandoned because of its proximity to a drainage ditch, and the fence was moved from the abandoned site to another site near Bldg. NM-37, where the fence was reconstructed. The disposal procedure practiced at this site was the same as that used at the former site, and one or two disposals of three or four drums each were conducted at this site.

Inspection of both the Apollo fuel disposal sites (site 10) indicated that the vegetation was not visibly stressed as a result of past disposal operations at each of the sites.

6.4.3.11 Instrument Repair Shop Drains (Site 11)

Unknown quantities of radium wastes from ships dials were poured down the sink drains in the instrument repair shop located in Bldg. V-60 (site 11). This shop was in operation from the late 1940s until 1956. As a result of pouring the radium wastes down the sink drains, the drain pipes and traps were contaminated. Consequently, the drain traps in Bldg. V-60 were plugged with concrete to avoid flushing the radium to the storm sewer system and ultimately to Willoughby Bay. In May 1982, Chem Nuclear of Barnwell, S.C., was awarded a contract to clean up the low-level radiological contamination in the plumbing of Bldg. V-60, and the cleanup procedure has been completed.

6.4.3.12 Alleged Mercury Disposal Site (Site 12)

In April 1976, personnel at the NAVAIREWORKFAC NORFOLK Materials Engineering Laboratory in Bldg. V-88 reported that, in the late 1960s, approximately one hundred and fifty 10-pound glass bottles containing elemental mercury were dumped off the seawall near Bldg. V-88 into Willoughby Bay (LANTNAVFACENGCOM, 1976b). Subsequently, bottom sediment samples were collected at the site for mercury analysis, and divers probed the sediments for the glass containers in 1976; however, no mercury or containers were detected (LANTNAVFACENGCOM, 1979b).

6.4.3.13 Past Industrial Wastewater Outfalls (Site 13)

Numerous industrial wastewaters generated by NAVAIREWORKFAC NORFOLK operations were discharged to the storm sewer system and ultimately to Willoughby Bay in the past. These wastewaters included metals plating solutions and rinse waters, parts cleaning solutions, and paint stripping wastewater. In early 1970, EPA (then known as the Federal Water Pollution Control Administration) determined that these industrial wastewater discharges (site 13) were a source of pollution with metals (primarily chromium, cadmium, and zinc; cyanide; oil and grease; and phenols) (Wiley and Wilson, 1971) to Willoughby Bay. Available sediment data for Willoughby Bay [Storage and Retrieval (STORET)] (EPA, 1982) indicates metals contamination. Consequently, virtually all of the industrial waste streams were routed to the IWTP, which was constructed to serve as a centralized pretreatment facility, with the effluent being discharged to the HRSD STP.

About 100,000 gallons per day of wastewater has been routed to the IWTP since it began operation in 1976. Although low-level contamination of the storm sewer system discharges from the NAVAIREWORKFAC NORFOLK area to Willoughby Bay has continued to occur since 1976, the contamination is attributed to stormwater runoff from this industrial area, rather than to discharges of industrial wastewater to the storm sewer. Recent violations of the NPDES permit limitations have most frequently occurred for cadmium, zinc, and oil and grease. The NPDES permit (NPDES permit No. VA0004413) covers nine stormwater outfalls in the NAVAIREWORKFAC NORFOLK area.

6.4.3.14 Underground Oil Spill--Piers 4, 5, and 7 (Site 14)

The seepage of an estimated 100 gallons per day of oil from behind the seawall near piers 4, 5, and 7 (site 14) to the Elizabeth River was detected in 1979. It was determined that oil had accumulated behind the seawall in these pier areas as a result of leaks in the pier fuel distribution system. A french drain was installed behind the seawall in this area to recover the oil, and approximately 50,000 gallons of oil was recovered from the french drain system using pumps (Environmental Resources Management, Inc., 1980). The french drain is periodically inspected for the accumulation of additional oil, but it was reported that none has been detected (Personal Communication, 1982).

6.4.3.15 Underground Oil Spill--Piers 20, 21, and 22 (Site 15)

An intermittent oil seepage from behind the seawall near piers 20, 21, and 22 (site 15) to the Elizabeth River was detected in ae minske 42118

1979. Although the soils behind the seawall were contaminated with oil, no free oil was found. The contaminated soils were removed, and no seepage of additional oil from behind the seawall has been detected since 1979.

6.4.3.16 Chemical Fire--Bldg. X-136 (Site 16)

On 18 Jul 1979, a chemical fire occurred in Bldg. X-136 (site 16) as a result of incompatible chemical storage, predominantly of calcium hypochlorite, acids, and organic solvents. During the fire-fighting operation, approximately 2 tons of calcium hypochlorite was flushed down the storm drain with water and ultimately to the Elizabeth River. The Virginia SWCB was informed of this flushing procedure, and no subsequent adverse water quality impacts to the Elizabeth River were observed (LANTNAVFACENGCOM, 1979c).

6.4.3.17 Chemical Fire--Bldg. SDA-215 (Site 17)

On 12 Aug 1981, a chemical fire occurred in cell 6 of Bldg. SDA-215 (site 17) as a result of incompatible chemical storage, predominantly of calcium hypochlorite, acids, and organic solvents. Considerable site contamination resulted from the fire and fire extinguishing operation. However, the site was cleaned up by removing remaining hazardous chemicals and residues, as well as contaminated soil adjacent to Bldg. SDA-215. These materials were contract hauled offsite to an EPA-approved hazardous waste disposal facility.

6.4.3.18 Former NM Hazardous Waste Storage Area (Site 18)

The former NM hazardous waste storage area (site 18) was used from 1975 until 1979 to store drums of hazardous wastes consisting mainly of waste oil, metals plating solutions and sludges, various chlorinated organic solvents (including TCE and 1,1,1-trichloroethane), acids, and paint stripping solutions. The storage area was an open earthen yard located east of the large steel storage buildings, known as the Taussig cans, in the NM area.

On 18 Jul 1979, Naval Safety Center personnel received an anonymous telephone call reporting that chemicals were being dumped into the drainage canal behind the Taussig cans. Subsequent inspection of the area by Navy personnel indicated that considerable leakage and intentional spillage of hazardous wastes onto the ground surface had occurred. Twenty-six drums were found in the area where intentional spillage had occurred. Six of these drums were lying on their sides, leaking their contents onto the ground through holes punched in the tops of the drums. A large ballpeen hammer and chisel were found on top of one of the upright drums (LANTNAVFACENGCOM, 1979c).

Consequently, a pit was excavated, and an existing drainage ditch was widened and lengthened to convey waste oil and contaminated stormater runoff to the unlined pit. Waste oil and contaminated runoff were periodically pumped from the pit into a tank truck, which transported it to the IWTP for treatment [Naval Facilities Engineering Command (NAVFACENGCOM), 1980].

Sampling and analysis of the soil in the spill area indicated that it was contaminated with metals, primarily chromium and cadmium. However, a sample of the soil was subjected to the EPA EP toxicity test and was found to be nonhazardous. The contaminated soil was then excavated and placed in piles near the spill area (NAVFACENGCOM, 1980). Subsequently, a landfill permit was obtained from the Virginia SDH in October 1980 for the one-time-only disposal of the contaminated soil at this site by grading and seeding it to establish a vegetative cover. In addition, the permit required a continuing monitoring program to determine if contaminant migration is occurring. The continuing monitoring program required the installation of a shallow ground water monitoring well downgradient from the site (northwest of the site), and monthly monitoring of the ground water monitoring well and the creek located north of the site.

Monitoring at the former NM hazardous waste storage area (site 18) is conducted as part of the NAVAIREWORKFAC NORFOLK NPDES monitoring program. Although the NAVAIREWORKFAC NORFOLK NPDES permit expired in December 1979, a new permit is pending. Because NPDES permits typically are issued for consecutive 5-year periods, the expiration date for the pending permit will likely be in late 1984 or early 1985. It was reported that the monitoring program at the former NM hazardous waste storage area (site 18) will continue, at least until the expiration date of the pending NPDES permit.

The continuing monitoring program included the sampling and analysis of shallow ground water standing in the pit that was excavated in 1979, in lieu of the collection of ground water samples from a monitoring well.

Section 6.5, Impacts of Installation Operations, discusses the results of this sampling and analysis program.

6.5 IMPACTS OF INSTALLATION OPERATIONS

6.5.1 Water Quality

6.5.1.1 Surface Water

Water quality in the estuarine area surrounding SPNC, including the Elizabeth River and Willoughby Bay, reflects the stressed environmental conditions caused by numerous local sewage and industrial discharges and nonpoint sources and shipping-related activities, particularly those upstream from SPNC on the Elizabeth River.

Elevated levels of phosphorus, nitrogen, and metals have been recorded in the Elizabeth River and are linked to similar readings exhibited by sediment samples taken near the SPNC piers. In particular, waste discharges upstream of SPNC have been cited as the cause of increased levels in the downstream waters (LANTNAVFACENGCOM, 1976a) and sediments of the Norfolk Harbor Channel of the Elizabeth River.

Nearly all the areas surrounding SPNC are closed to shellfishing (oysters and clams). The entire length of the Elizabeth River, including the Hampton Roads area located to the northwest of SPNC, is a condemned area for shellfishing. Willoughby Bay historically been closed due to metals pollution. Reasons given by the Virginia SDH for the current closures in Willoughby Bay, Hampton Roads, and the Elizabeth River include traffic problems associated with the high level of shipping activities, nonpoint source pollution, and high fecal coliform levels. The fecal coliform levels are primarily due to sewage outfalls located farther upstream on the Elizabeth River.

The volume of shipping activities at SPNC makes the release of some quantity of oil and grease unavoidable. Likewise, the volume and complexity of storage and distribution facilities make some spillage, pipeline leakage, and thus release to the water likely, despite all efforts to avoid and/or clean up such releases.

Industrial operations at NAVAIREWORKFAC NORFOLK have in the past contributed, and to a limited extent currently contribute, to adverse environmental impacts in Willoughby Bay. This activity, like others at SPNC, historically disposed of wastes in storm sewers discharging directly to Willoughby Bay. However, since 1976, virtually all of NAVAIREWORKFAC NORFOLK's industrial wastewaters have been discharged to the HRSD STP, rather than to the storm sewer. In addition, NAVAIREWORKFAC NORFOLK storm sewer outfalls have been covered under NPDES permits. Although violations of the NPDES permit limitations still occur sporadically, the violations are attributed to stormwater runoff from this industrial area, rather than to discharges of industrial wastewater to the storm sewer. Nevertheless, the past discharge of industrial wastewaters from SPNC has contributed to the metals contamination found in Willoughby Bay.

In summary, existing data show that the waters and sediments in areas surrounding SPNC have been degraded by industrial and domestic waste discharges. However, given the number of discharges and the complexity of mixing and flow patterns in this tidal area, it is not possible to quantify what portion of this degradation derives from past or current operations at SPNC and what portion is attributed to other sources.

6.5.1.2 Ground Water

Many of the disposal sites identified at SPNC are potential sources of ground water pollution. However, only at the Camp Allen landfill (site 1) and the former NM hazardous waste storage area (site 18) have data been collected to determine if such pollution actually exists.

Seven monitoring wells are in place in and around the Camp Allen landfill (site 1), and they have been tested periodically since 1974 for a range of constituents, including chromium, lead, mercury, silver, zinc, arsenic, and phenols (see figure 5.3-3 for the locations of these monitoring wells). During the onsite IAS survey, these wells were found to be generally inadequate for the collection of representative samples of ground water. This was because several of the wells had missing caps or riser pipes, and the tops of some of the wells were below the surrounding ground surface. Consequently, several of the wells are susceptible to surface water inflows. With regard to the ground water sample analyses, the analytical methods used for phenols, silver, and arsenic had detection limits higher than existing Virginia ground water standards (table 6.5-1). In these cases, the constituent may have been present in a concentration exceeding the standard but not high enough to have been detected in the analysis.

Mercury and arsenic were not detected in any of the wells. Violations of the standards for chromium, lead, silver, zinc, and phenols have occurred. (High zinc levels may be attributed to the use of galvanized well casings.) The following paragraphs summarize existing data for these wells.

Well 1: Appears to have some slight contamination with phenols, chromium, zinc, and lead, since values exceeding the standards were detected.

Well 2: Appears to have some slight contamination with phenols and zinc. Chromium and lead values exceeded the standards during the early monitoring (1974-75) but do not appear to be a current problem.

Well 3: High zinc levels averaging 26.6 milligrams per liter were detected, and silver was detected at 0.63 milligram per liter.

Well 4: The zinc and phenols concentrations exceeded the standard in several samples. Well 4 also had one sample with a lead concentration of 0.22 milligram per liter.

Well 5: Occasional high levels of phenols and lead were noted during the early monitoring (1974-75), but these parameters have been in compliance since 1979. Zinc has been detected in all samples analyzed and averages 33.7 milligrams per liter.

Well 6: Chromium has been detected at 0.1 milligram per liter during the last two sampling efforts, but, historically, chromium levels have been in compliance. Zinc and silver were

Table 6.5-1
Virginia Ground Water Standards

Parameter	Virginia Ground Water Standard (mg/l)
Cadmium	0.0004
Chromium	0.05
Lead	0.05
Mercury	0.00005
Silver	None
Zinc	0.05
Arsenic	0.05
Phenols	0.001

mg/l = milligrams per liter.

Source: Commonwealth of Virginia SWCB, 1980.

present in the two samples analyzed, and both exceeded the standard.

Well 7: Phenols and chromium appeared to exceed the standards during the early monitoring (1974-75), but have not been a problem during the last several years. Zinc levels in well 7 are high and average 51 milligrams per liter.

These data suggest that the wastes buried at the Camp Allen landfill (site 1) may be contributing contaminants to the shallow ground water, although the data are insufficient to determine any trends in contamination levels or to deliniate the area involved. Since a connection may exist between the water table aquifer and the Yorktown Aquifer in this area due to the absence of impermeable deposits which generally separate them, it is possible that any contamination present could be introduced into this deeper aquifer.

Following the July 1979 spillage of suspected hazardous substances at the former NM hazardous waste storage area (site 18), the Commonwealth of Virginia requested that a monitoring well be installed downgradient of the site but gave permission for monthly samples to be taken from the pit excavated near the spill site behind the Taussig cans until the monitoring well was installed. As of May 1982, the monitoring well had not been installed, but monthly samples had been collected from the pit. Surface runoff is included in the samples, which may, therefore, not properly represent the ground water conditions.

Regarding sample analyses, the analytical methods used to monitor cadmium had a detection limit higher than the Virginia ground water standard for this parameter. Thus, any detectable value represents a violation of the criteria. Seven of the 27 monthly monitoring analyses for cadmium were detectable. Although no cadmium was detected in the other samples, cadmium concentrations for these samples may also have exceeded the ground water standard.

Only 4 of the 27 samples analyzed exceeded the Virginia ground water standard for chromium. The maximum concentration detected was 0.16 milligram per liter, and the average of the four sample concentrations that exceeded the standard was 0.13 milligram per liter.

The monthly cyanide analyses showed some elevated levels of cyanide between May and September of 1980, with the average concentration of cyanide during this period (average of 0.026 milligram per liter) approximately 5 times the ground water standard. Cyanide analyses during the last year have all been in compliance with the standard.

The Commonwealth of Virginia does not have a ground water standard for oil and grease, but analyses did detect oil and grease concentrations above the method detection limit of 1 milligram per liter. Of the 27 samples analyzed, 14 were at detectable levels.

Thirteen of these were less than 55 milligrams per liter. One sample was measured at 1,289 milligrams per liter, which may be attributable to runoff following a storm.

Eighteen of the 26 samples analyzed for phenols were above the detection limit and exceeded the Virginia ground water standard, with a high of 0.276 milligram per liter being detected on one occasion. Of the eight samples that were below the detection limit, which varied for different samples, only two were known to be below the standard. For the other six analyses, the detection limit was higher than the standard, and, therefore, it is not possible to determine if the phenols concentrations for these samples exceeded the standard. Table 6.5-2 provides results of ground water monitoring at the former NM hazardous waste storage area (site 18).

In addition to sampling the pit, the creek located north of the site was sampled and analyzed monthly. Table 6.5-3 lists the maximum and average detectable concentrations that occurred during the monitoring period. The data are similar to the monitoring results for the samples collected from the pit (table 6.5-2) and show slightly elevated levels of chromium, cadmium, and cyanide. The oil and grease and phenols concentrations are typical for surface water in a shrub-pine ecosystem, such as the one near the creek in this area. No excessive contamination appears to exist in this creek near the disposal site.

Monitoring of the surface and ground water in the former NM hazardous waste storage area (site 18) is continuing to determine if contaminant migration is occurring. Consequently, no further action is recommended at this site.

6.5.2 Biota

The elevated concentrations of oil and grease and metals in the waters and sediments of the Elizabeth River and Willoughby Bay have had a direct impact on area biota. Elevated levels of oil and grease found in the SPNC area limit primary productivity and can cause tainting of fish and shellfish. The Elizabeth River and Willoughby Bay are condemned for shellfishing in the area of SPNC. This restriction, which applies to oysters and clams, has historically been in effect due to high concentrations of metals in the sediments and water column and is currently in effect due to the heavy shipping traffic in the area and the elevated levels of fecal coliforms (Commonwealth of Virginia, SDH, 1960; 1976; 1981; and 1982). The historical untreated discharges of industrial wastewaters generated by NAVAIREWORKFAC NORFOLK operations to Willoughby Bay were likely a contributor to contamination in this area. The current elevated levels of fecal coliforms in the waters in the SPNC area are from nondefined sources and are not likely caused by SPNC activities.

Dredging, which is required to keep the Elizabeth River channel open and access to SPNC available, as well as nearshore ship traffic,

Table 6.5-2
Monitoring Results from the Detention Pit near the
Former NM Hazardous Waste Storage Area (Site 18)

Parameter	Highest Concentration Detected During Monitoring* (mg/l)	Average of Detectable Concentrations (mg/l)	Virginia Ground Water Standards (mg/l)
Cadmium	0.043	0.019	0.0004
Chromium	0.16	0.07	0.05
Cyanide	0.042	0.012	0.005
Oil and Grease	1,289	10.7†	--
Phenols	0.276	0.027	0.001

-- = Not applicable.

* Monitoring period February 1980 through April 1982.
† Average of detectable values with highest value omitted.

Sources: Commonwealth of Virginia SWCB, 1980.
EPA, 1982.

Table 6.5-3
Monitoring Results for the Creek Located North
of the Former NM Hazardous Waste Storage Area (Site 18)

Parameter	Highest Concentration Detected During Monitoring* (mg/l)	Average Value of Detectable Concentrations (mg/l)
Cadmium	0.064	0.020
Chromium	0.184	0.088
Cyanide	0.07	0.017
Oil and Grease	31	7.9
Phenols	0.09	0.16

* Monitoring period February 1980 through April 1982.

Source: EPA, 1982.

resuspends metal-contaminated sediment into the water column. The release of settled metals into the water column makes them more available for bioaccumulation. The dredging and ship traffic also destroy rooted vegetation and increase turbidity, both of which tend to limit primary productivity. The limited productivity also decreases the utility of the area for feeding and nursery grounds.

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APPENDIX A

LIST OF ACRONYMS, SHORT TITLES, AND ABBREVIATIONS

LIST OF ACRONYMS, SHORT TITLES, AND ABBREVIATIONS

AFSC	Armed Forces Staff College
AIMD	Aircraft Intermediate Maintenance Department
AVGAS	aviation gasoline
AVOIL	aviation oil
BBL	barrels
Be	beryllium
CBU-411	Construction Battalion Unit 411
Cd	cadmium
CINCLANTFLT	Commander in Chief, U.S. Atlantic Fleet
CNM	Chief of Naval Material
CNO	Chief of Naval Operations
COE	U.S. Army Corps of Engineers
COMNAVBASE NORFOLK	Commander, Naval Base Norfolk
CONUS	Continental United States
Cr	chromium
CSRS	Confirmation Study Ranking System
Cu	copper
DDESB	Department of Defense Explosives Safety Board
DFM	diesel fuel marine
DLA	Defense Logistics Agency
DoD	Department of Defense

DPDO	Defense Property Disposal Office
EP	extraction procedure
EPA	U.S. Environmental Protection Agency
FASOTRAGRULANT	Fleet Aviation Specialized Operational Facilities Training Group, Atlantic
FICEURLANT	Fleet Intelligence Center, Europe/Atlantic
FLTASWTRACEN	Fleet Anti-Submarine Warfare Training Center
FMFLANT	Fleet Marine Force, Atlantic
FTC	Fleet Training Center
GSE	ground support equipment
HRSD	Hampton Roads Sanitation District
IAS(s)	Initial Assessment Study(ies)
IWTP	industrial waste treatment plant
JP-5	jet fuel
LANTFLT HEDSUPPACT	U.S. Atlantic Fleet Headquarters Support Activity
LANTNAVFACENGCOM	Atlantic Division, Naval Facilities Engineering Command
LTA	lighter-than-air
mg/l	milligrams per liter
MOGAS	motor vehicle gasoline
MOTU-2	Mobile Technical Unit 2
MSL	mean sea level
NACIP	Navy Assessment and Control of Installation Pollutants
NAVAIREWORKFAC NORFOLK	Naval Air Rework Facility, Norfolk

NAVAIRSYSCOM	Naval Air Systems Command
NAS NORFOLK	Naval Air Station, Norfolk
NAS OCEANA	Naval Air Station, Oceana
NATO	North Atlantic Treaty Organization
NAVBASE NORFOLK	Naval Base, Norfolk
NAVCAMSLANT	Naval Communication Area Master Station, Atlantic
NAVENPVNTMEDU TWO	Navy Environmental Preventive Medicine Unit No. 2
NAVFACENGCOM	Naval Facilities Engineering Command
NAVSAFECEN	Naval Safety Center
NAVSEASYSCOM	Naval Sea Systems Command
NAVSTA NORFOLK	Naval Station, Norfolk
NEESA	Naval Energy and Environmental Support Activity
NESO	Navy Environmental Support Office
Ni	nickel
NM	naval magazine
NOB	Naval Operating Base
NORFOLKNAVSHIPYD	Norfolk Naval Shipyard
NPDES	National Pollutant Discharge Elimination System
NPPSO	Naval Printing and Publications Service Office
NRDC	Navy Regional Dental Center
NRMC	Navy Regional Medical Center
NSC-CI	Naval Supply Center-Craney Island
NSC NORFOLK	Naval Supply Center, Norfolk

NUWPNTRAGRULANT	Nuclear Weapons Training Group, Atlantic
OBA	oxygen breathing apparatus
OESO	Ordnance Environmental Support Office
OPTEVFORLANT	Operational Test and Evaluation Force
OWTP	oily wastewater treatment plant
PCB(s)	polychlorinated biphenyl(s)
POL	petroleum, oils, and lubricants
PVC	polyvinyl chloride
PWC NORFOLK	Navy Public Works Center, Norfolk
RFI	Ready for Inventory
RSO	Radiation Safety Officer
SACLANT	Supreme Allied Command, Atlantic
SDH	State Department of Health
SIMA NORFOLK	Shore Intermediate Maintenance Activity, Norfolk
SIMA PORTSMOUTH	Shore Intermediate Maintenance Activity, Portsmouth
SPCC	Spill Prevention Control and Countermeasure
SPNC	Sewells Point Naval Complex
STORET	Storage and Retrieval
STP	sewage treatment plant
SWCB	State Water Control Board
SWOBs	ship waste offloading barges
TCE	1,1,1-trichloroethylene
USGS	U.S. Geological Survey
USSCS	U.S. Soil Conservation Service
VAES	Virginia Agricultural Experiment Station
Zn	zinc

APPENDIX B

PARTIAL LISTING OF TENANT ACTIVITIES ON SPNC

LIST OF RESIDENT ACTIVITIES
NAVAL AIR STATION (NAS)
NORFOLK, VA.

1. Aircraft Ferry Squadron THIRTY ONE
Bldgs. SP-65, SP-122

2. ARINC Research Corporation
Bldg. U-48

3. Atlantic Fleet Audio Visual Command
Bldg. V-64

4. Atlantic Fleet Band
Bldg. SP-70

5. Aviation Material Office, Atlantic
Bldg. T-26

6. Breezy Point Kindergarten NAS
Bldg. SP-129

7. Bureau of Customs
Bldg. R-48

8. Carrier Airborne Early Warning Wing 12
Bldg. SP-65

9. Carrier Airborne Early Warning Squadron 78
Hangar LP-12

10. Carrier Airborne Early Warning Training Squadron 120
Hangars SP-2, SP-232

11. Carrier Airborne Early Warning Squadron 121
Hangar SP-1

12. Carrier Airborne Early Warning Squadron 122
Hangar SP-1

13. Carrier Airborne Early Warning Squadron 123

14. Carrier Airborne Early Warning Squadron 124

15. Carrier Airborne Early Warning Squadron 125

16. Carrier Airborne Early Warning Squadron 126
Hangar SP-1

17. Commander Carrier Group FOUR--Deployed

18. Commander Carrier Group EIGHT--Deployed

19. Commander Reserve Patrol Wing Atlantic
Bldg. LP-74

20. Defense Mapping Agency, Norfolk Office
Bldg. SP-[illegible]

21. Douglas Aircraft Company
Bldgs. SP-86, [illegible]

22. Embry Riddle Aeronautical University
Hangar LP-14

23. Fleet Aviation Specialized Operational Training Group, Atlantic Fleet
Bldgs. SP-257, 254, 362, 366, 120

24. Fleet Composite Squadron SIX
Bldgs. U-48, 58, 102

25. Fleet Electronic Warfare Support Group
Bldg. SP-71

26. Fleet Logistics Support Squadron FORTY
Hangar SP-2

27. Fleet Logistics Support Squadron FIFTY SIX
Hangar SP-31

28. Fleet Tactical Support Wing ONE
Bldg. SP-65

29. Fleet Technical Support Center
Bldg. R-47

30. Grumman Aerospace Corporation
Bldg. SP-373

31. Helicopter Anti Submarine Squadron Light THIRTY
Hangars LF-60, SP-234, U-48, LF-62

32. Helicopter Anti Submarine Squadron Light THIRTY TWO
Hangar LP-13

33. Helicopter Anti Submarine Squadron Light THIRTY FOUR
Hangar LP-13

34. Helicopter Attack Squadron Light FOUR
Hangar LP-12

35. Helicopter Combat Support Squadron SIX
Hangar LP-4

36. Helicopter Mine Countermeasures Squadron 12
Hangar SP-31

37. Helicopter Mine Countermeasures Squadron 14
Hangar LP-3

38. Helicopter Mine Countermeasures Squadron 16
Hangar LP-3

39. Helicopter Sea Control Wing ONE
Hangar LP-2

40. Lockheed Aircraft Corporation
Bldgs. T-26, S-3

41. Marine Aircraft Group Detachment 46 ALFA
Hangar LP-2

42. Marine Barracks
Bldg. MB-28

43. McDonnell - Douglas Corporation
Bldg. S-29

44. Military Air Traffic Coordination Office
Bldg. LP-84

45. NAS Cooperative Association
Bldgs. V-60, LF-18, U-132, V-53, V-88

46. NAS Employees Recreation and Welfare League

47. NAS Little League

48. NAS Mutual Aid Association

49. Naval Air Force Atlantic Fleet
Bldgs. T-26, S-3, R-46, 47

50. Naval Air Maintenance Training Group Detachment
Bldgs. SP-256, 254, 232

51. Naval Air Norfolk Federal Credit Union
Bldgs. U-20, V-60

52. Naval Air Reserve Unit
Hangar LP-12

53. Naval Air Rework Facility
Bldg. V-28, et al.

54. Naval Air Technical Services Facility, Quality Assurance Division, Atlantic
Bldg. R-48

55. Naval Air Technical Training Center, Lakehurst Detachment
Bldg. U-46

56. Naval Audit Site
Bldg. V-53

57. Naval Aviation Engineering Service Unit, Atlantic
Bldg. S-3

58. Naval Aviation Logistic Center DET EAST NAS NORVA
Bldg. R-48

59. Naval Communication Area Master Station Atlantic
Bldgs. N-26 (NAS R-56, SP-65)

60. Naval Construction Battalion Unit 411
Bldg. LAG-11

61. Naval Eastern Oceanography Center, Norfolk
Bldg. U-117

Mobile Environmental Team Atlantic
Bldg. U-117

62. Naval Investigative Service Resident Agency Norfolk
Bldg. U-40

63. Naval Maintenance and Supply Systems Office
Bldgs. R-51, 52, 50

64. Naval Regional Dental Center
Bldg. CD-4, Trailer (SP area)

65. Naval Regional Medical Center

Naval Aviation Physiology Training Program
Bldg. S-33

Naval Aviation Water Survival Training Program
Bldg. U-40

Naval Laboratory Services, Toxicology Branch Laboratory
Bldg. S-33

Regional Medical Branch Clinic
Bldg. V-9

Audio Testing Center
Bldg. V-28

66. Naval Safety Center
Bldgs. SP-49, 50, 52

67. Naval Sea Cadets Corps
Bldg. SP-64

68. Naval Station
Bldgs. U-115, 40, SP-46, SP-53, SP-314

69. Naval Supply Center
Bldgs. LP-84, 100, 205

SER Wholesale/Retail Function
Bldgs. LP-26, SP-86, 87, 236, 237, 359, V-29, 52, 60

70. Naval Telecommunication Center Breezy Point
Bldg. SP-65

71. Naval Training Equipment Center Representative Atlantic, Field Engineer Office
Bldg. SP-17

72. Navy Courier Service Detachment VICTOR
Bldg. LP-82

73. Navy Exchange (COMNAVBASE NX)
Bldgs. U-40, V-57, LP-1, LP-84

74. Navy Material Transportation Office
Bldg. X-133 (QUICKTRANS LP-117)

75. Navy Publication and Printing Service Detachment Office, Reprographics Facility
Bldg. V-28

76. Navy Regional Data Automation Center
Bldg. V-53

77. Navy Wives Club of America
Bldg. SP-70

78. Personnel Support Detachment, NAS Norfolk
Bldg. S-29

79. Public Works Center
    Bldg. V-49--Repair Shop
    Bldg. NM-59A--Storage

80. Resident Officer in Charge of Construction, Sewells Point Area
    Bldg. U-46

81. SERV-AIR Incorporated
    Bldg. SP-86

82. Shore Intermediate Maintenance Activity, Portsmouth
    Bldg. V-58, V-36

83. Tactical Electronic Warfare Squadron 209
    Hangar LP-12

84. United Virginia/Seaboard National Bank
    Bldg. U-20

85. U.S. Post Office
    Bldg. U-20

86. Virginia Commission for the Visually Handicapped
    Bldg. R-46 (Cafeteria)

Source: NAS, 1981.

TENANT ACTIVITIES OF THE NAVAL STATION, NORFOLK (NAVSTA NORFOLK)

Tenant Activities

Personnel Support Activity, Norfolk

Personnel Support Activity Branch Office, Naval Station

Navy Publications and Printing Service Office

Mobile Technical Unit TWO

Atlantic Division, Naval Facilities Engineering Command

Post Office (Hampton Roads Branch)

Office of Civilian Personnel, Southern Field Division

Naval Investigative Service Office, Norfolk

Commander Naval Surface Force Atlantic, Readiness Support Group

Director, Fleet Home Town News Center

Naval Legal Service Office

Naval Communication Area Master Station, Atlantic

Navy Environmental Health Center

Fleet Training Center

Atlantic Representative, Chief of Naval Reserve

Fleet Accounting and Disbursing Center, U.S. Atlantic Fleet

Human Resource Management Center

Nuclear Weapons Training Group, Atlantic

Naval Surface Weapons Center Detachment Fort Monroe, Fort Story

Naval Regional Dental Center

TENANT ACTIVITIES OF THE NAVAL STATION, NORFOLK (NAVSTA NORFOLK)
(Continued, Page 2 of 3)

<u>Tenant Activities</u> (continued)

Navy Manpower and Material Analysis Center, Atlantic

Naval Alcohol Rehabilitation Center

Navy Public Works Center (Telephone Exchange, Public Works Shop, Janitorial Storage)

Naval Air Station (Enlisted Club, Petty Officer's Club, Officer's Mess, Package Store)

Shore Intermediate Maintenance Activity, Norfolk

Navy Public Affairs Center, Atlantic

Naval Ship Engineering Center, Norfolk Division

Naval Weapons Station, Yorktown (Bldg. CA-495)

Naval Security Group Activity, Northwest (Bldg. CEP-113)

Navy Youth Programs Manager, Area FIVE

TIDEWATER Judicial Circuit, Navy-Marine Corps Trail Judiciary

Naval Sea Support Center, Atlantic (CEP-117, SC-413, X-18, Collimation Tower)

Naval Regional Medical Center, Sewells Point Branch Clinic

Commander in Chief U.S. Atlantic Fleet (Boathouse)

Commander Operational Test and Evaluation Force (Bldg. CA-99)

Atlantic Fleet Headquarters Support Activity (Bldg. CA-14)

Supervisor, Shipbuilding, Conversion and Repair, Portsmouth (Bldg. W-7)

Marine Barracks, Norfolk (Gate Sentry)

TENANT ACTIVITIES OF THE NAVAL STATION, NORFOLK (NAVSTA NORFOLK)
(Continued, Page 3 of 3)

Non-Federal Activities

American Red Cross

Navy Relief Society

COMFIVE Federal Credit Union

Tidewater Consortium

Golden Gate University

Source: COMNAVBASE NORFOLK, 1978.

TENANT ACTIVITIES OF THE
NAVAL SUPPLY CENTER, NORFOLK (NSC NORFOLK)

American Federation of Government Employees

Defense Property Disposal Office

Fitting Out Supply Assistance Team

Fleet Accounting and Dispursing Center, U.S. Atlantic Fleet

International Association of Machinists and Aerospace Workers

Military Sealift Command

Naval Electronics Systems Command Material Representative

Naval Investigative Service Resident Agent

Naval Supply Occupational Safety and Health Group, Norfolk

Naval Telecommunications Center

Navy Audit Service, Southeast Region

Navy Food Management Team

Navy Material Transportation Office

Navy Publications and Printing Service Center

Navy Regional Medical Center Branch Clinic

Navy Resale System Field Support Office

NSC Cafeteria

NSC Federal Credit Union

Precious Metals Area Representative (DLA)

Ships Force Overhaul Management Branch

Supply Systems Security Group-Norfolk

U.S. Customs Service, Department of Treasury

U.S. Army Veterinary Activity, Norfolk Branch

Source: NSC NORFOLK, 1981b.

TENANT ACTIVITIES OF THE
U.S. ATLANTIC FLEET HEADQUARTERS SUPPORT ACTIVITY
(LANTFLT HEDSUPPACT)

Commander-in-Chief, U.S. Atlantic Fleet

Supreme Allied Commander, Atlantic (NATO)

Fleet Intelligence Center Europe and Atlantic

Oceanographic Systems, Atlantic

Atlantic Command Operations Support Facility

Personnel Support Activity Detachment

Commander, Submarine Force, U.S. Atlantic Fleet

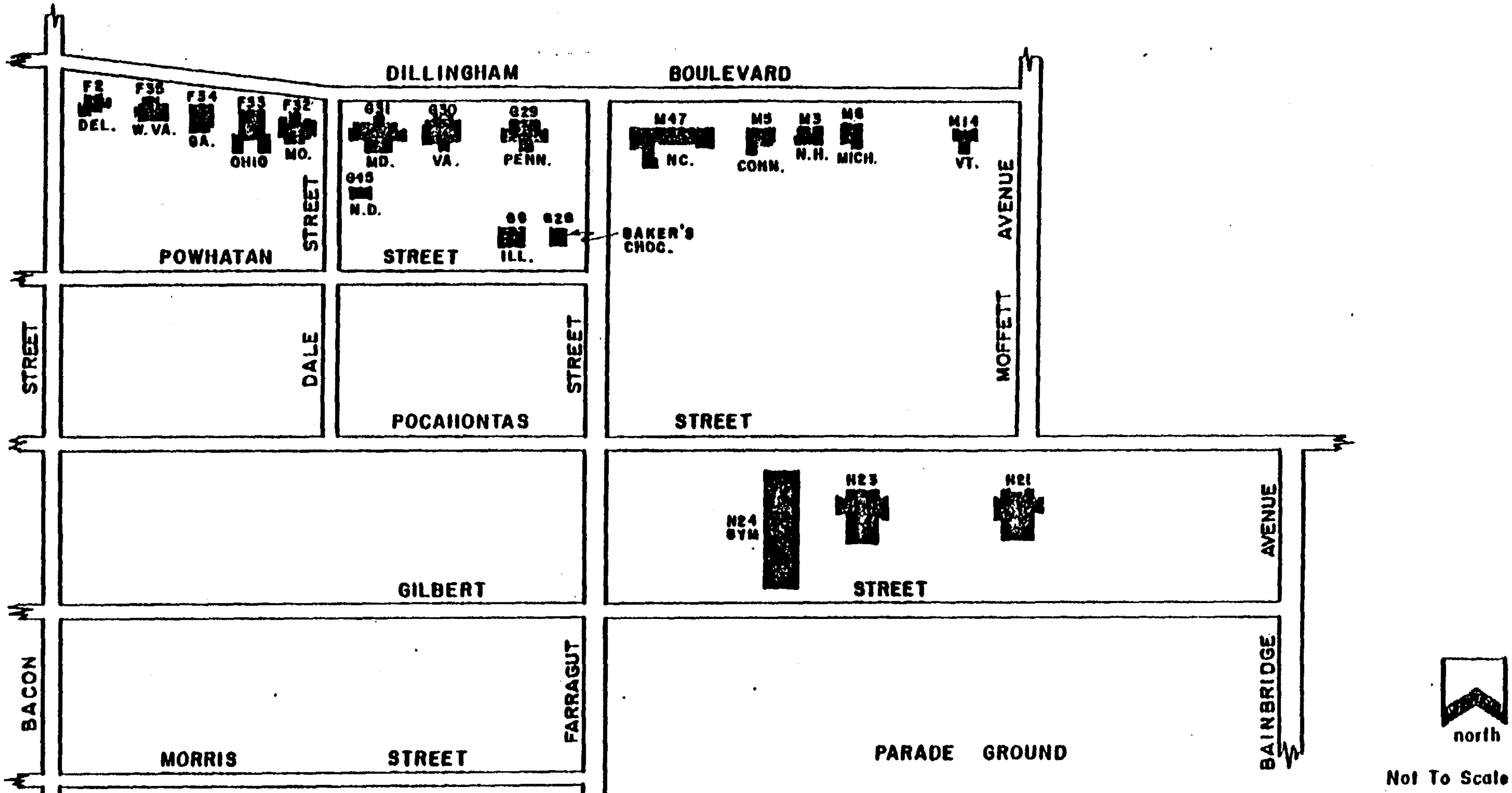
Commander, Naval Surface Force, U.S. Atlantic Fleet

Atlantic Command Electronic Intelligence Center

Source: COMNAVBASE NORFOLK, 1982.

APPENDIX C

HISTORICAL SITES ON SPNC



Sewells Point Area Navy Complex

HISTORIC PRESERVATION
NATIONAL REGISTER

Source: LANTNAVFACENGCOM, n.d.

APPENDIX D

CHEMICALS STORED IN CELL 6 OF BLDG. SDA-215

PRIOR TO THE 12 AUG 1981 FIRE

Table D-1
Inventory of Chemicals Stored in Cell 6 of Bldg. SDA-215
Prior to the 12 Aug 1981 Fire

Item	Amount
Welding Flux	300 lbs
Sodium Peroxide	843 lbs
Potassium Superoxide	75,970 lbs
Sodium Chlorate	92,650 lbs
Chromic Acid	1,240 lbs
Calcium Hypochlorite	3,804 gal
Hydrogen Peroxide	5 gal
Sodium Nitrate	26,740 lbs
Sodium Chromate	776 lbs
Potassium Permanganate	1,034 lbs
Silver Nitrate	83 lbs
Ammonium Nitrate	105 lbs
Mercuric Nitrate (Liquid)	24 gal
Potassium Chromate	80 gal
Nitric Acid	292 gal
Sodium Bisulfite	280 lbs
Potassium Dichromate	3,075 lbs
Laundry Bleach (NSN 6850-00-063-2842)	12,340 lbs
TOTAL	>125 tons

Source: LANTNAVFACENGCOM, 1981a.

APPENDIX E

INVENTORY OF HAZARDOUS ITEMS PHYSICALLY NOT ACCEPTED BY DPDO

HAZARDOUS ITEMS WHICH CANNOT BE PHYSICALLY ACCEPTED BY DPDO: (List not inclusive)

2910-00-646-9729	Cartridge, engine start
3655-00-093-6447	Generator hydrogen
3680-00-164-3640	Facing powder, bitum
5640-00-158-8885	Insulation tape
5640-00-551-5028	Insulation sleeving
6135-00-485-7402	Mercury battery
6665-00-878-0489	Calcium metallic
6750-00-200-2403	Sodium Sulfide Fuse
6810-00-043-0753	Sodium Phosphate
6810-00-043-0780	Sodium Phosphate
6810-00-043-0783	Sodium Phosphate
6810-00-058-6987	Benzene Technical
6810-00-063-6115	Nitrobenzene Reagent
6810-00-111-0564	Ion exchange compound
6810-00-111-0567	Ion exchange compound
6810-00-140-0889	Morpholine technical
6810-00-141-3745	Sodium arsenite
6810-00-145-0476	Sodium hydroxide
6810-00-148-7151	Potassium hydroxide
6810-00-148-7152	Maganese sulfate
6810-00-148-7153	Sulfuric acid
6810-00-148-7155	Nitric acid reagent
6810-00-148-7156	Sodium thiosulfate
6810-00-149-0292	Potassium hydroxide
6810-00-149-0577	Mannitol ACS
6810-00-149-7005	Xylene ACS
6810-00-174-6587	Tannic acid
6810-00-174-6591	Nitrobenzene ACS
6810-00-181-8321	Ion exchange compound
6810-00-181-8322	Ion exchange compound
6810-00-181-8324	Ion exchange compound
6810-00-181-8325	Ion exchange compound
6810-00-222-8161	Benzene ACS
6810-00-234-1981	2,4 - Dinitrophenol, R
6810-00-234-1989	2,4,6 - Trinitrobenzo
6810-00-234-2042	2,4 - Dinitrophenylhy
6810-00-240-2119	Sodium Chromate
6810-00-242-4770	Calcium hypochlorite tech.
6810-00-246-6472	Benzene technical
6810-00-255-0471	Calcium hypochlorite crystal
6810-00-255-0472	Calcium hypochlorite
6810-00-257-3819	Benzene technical
6810-00-264-6722	Acid
6810-00-264-8990	Ethylene chlorohydrin reagent
6810-00-264-9000	Chlorobenzene technical
6810-00-270-5553	Sodium thiosulfate
6810-00-270-6207	Monoethanolamine
6810-00-270-8289	O-Tolidine Dihydroc
6810-00-281-2764	Benzene technical
6810-00-281-4163	Mercuric nitra
6810-00-281-5267	Benzene ACS

HAZARDOUS ITEMS WHICH CANNOT BE PHYSICALLY ACCEPTED BY DPDO: (CONTINUED)

6810-00-281-5265	Benzene ACS
6810-00-281-5266	Benzene ACS
6810-00-281-5268	Benzene reagent
6810-00-281-5272	Benzene technical
6810-00-281-5276	Benzene reagent
6810-00-281-7450	Mercury ACS (5-lbs)
6810-00-281-7452	Mercury ACS (25-lbs)
6810-00-290-7104	Methyl Ethyl Ketone
6810-00-292-9625	Trichlorothane
6810-00-300-5155	Sodium arsenite
6810-00-357-7979	Benzene technical
6810-00-368-5020	Benzene ACS
6810-00-387-5425	Benzene ACS
6810-00-576-8438	Pyrogallol analyzed
6810-00-664-1576	Pyrogallol technical
6810-00-726-7944	Charcoal activated
6810-00-753-4787	Xylene ACS
6810-00-753-4788	Xylene ACS
6810-00-764-4312	Tannic acid
6810-00-815-6105	Xylene ACS
6810-00-820-0496	Xylene ACS
6810-00-903-7093	Benzene ACS
6810-00-905-4303	Xylene ACS
6810-00-935-1034	Potassium iodide
6810-00-957-8754	Benzene ACS
6810-00-958-2198	Ethlyene chlorohydrin reagent
6810-00-958-2207	Xylene ACS
6810-00-973-8588	Benzene ACS
6810-00-985-7090	Ammonium hydroxide ACS
6810-00-985-7091	Ammonium hydroxide ACS
6810-00-995-4804	Diethylenetriamine
6810-01-003-1078	Sodium azide reagent
6810-01-017-3542	Formaldehyde solution reagent
6810-01-018-3118	Benzene ACS
6810-01-018-6726	Ammonium hydroxide reagent
6810-01-018-9769	Ammonium hydroxide reagent
6810-01-020-9872	Morpholine reagent
6810-01-021-0355	Iodine solution
6840-00-082-2541	Insect and leech repellant
6840-00-180-6069	Insecticide
6840-00-246-6432	Insecticide DDT
6840-00-264-6692	Insecticide DDT
6840-00-285-7091	Rodenticide zinc phosphate
6840-00-411-8083	Rodenticide zinc phosphate
6840-00-559-1550	Bird repellant
6840-00-582-4651	Formicide
6840-00-864-5432	Insect repellant
6850-00-197-6804	Cleaning compound solvent
6850-00-835-0484	Deicing - Defrosting
8010-00-181-7161	Epoxy primer coating kit
8010-00-262-9011	Adhesive
8030-00-165-8577	Coating compound

HAZARDOUS ITEMS WHICH CANNOT BE PHYSICALLY ACCEPTED BY DPDO: (CONTINUED)

8040-00-262-9011	Adhesive
8040-00-273-8697	Adhesive

Radioactive items will be handled in accordance with DoD 4160.21-M and if it is to be turned in to the DPDO, it will be accepted in-place and must have approval of the Radiation Protection Officer (RPO) in writing.

The following are examples of Radioactive items acceptable in the DPDO account (in-place) but the list is not all inclusive.

4220-00-639-8999	Wrist depth gage
4220-00-943-7307	Hydrographic depth gage
6605-00-079-0007	Submersible wrist compass
6605-00-151-5337	Lensatic compass
6605-00-307-1322 (3c7)	Compass magnetic
6605-00-809-5252	Compass magnetic unmounted
6605-00-846-7618	Lensatic compass
6605-00-878-0490	Tritium water standard
6645-00-752-8638	Submersible wrist watch
6665-00-526-8645	Radiac set

The following stock numbered items <u>will not be accepted</u> by the DPDO either physically or in-place.

Any item in FSC 4470
Any item with SMIC (cc 21-22 of the 1348-1) X2

6850-00-753-4827	DS2
6850-00-753-4870	DS2

APPENDIX F

IN-SERVICE PCB-CONTAINING TRANSFORMERS LOCATED IN THE NAVAIREWORKFAC NORFOLK AREA

Table F-1
In-Service PCB-Containing Transformers Located in the NAVAIREWORKFAC NORFOLK Area

Identification Number	Location	Quantity (pounds)
6536628	Bldg. U-132, Room 110	6,402
6536630	Bldg. U-132, Room 110	6,402
6540816	Bldg. U-132 North	1,595
3412-1	Bldg. U-132, Room 210	4,444
3412-2	Bldg. U-132 South	4,444
PWC-806	#1-Bldg. LF-18	4,950
PWC-807	#1-Bldg. LF-18	4,950
PWC-808	#2-Bldg. LF-18	4,950
PWC-809	#2-Bldg. LF-18	4,950
PWC-810	#3-Bldg. LF-18	2,750
PWC-811	#3-Bldg. LF-18	2,750
G-856213A	Outside Vault Bldg. LF-18	1,705
G-856213B	Outside Vault Bldg. LF-18	1,705
7026443	Outside Vault Bldg. LF-34	2,992
H-31546370P	Outside Vault Bldg. LF-38	506
G-852890	Outside Vault Bldg. LF-53	2,750
E-692096	Bldg. LP-21	1,595
PCV8395-01	Bldg. LP-167-Door 34	3,905
PAV1723-01	Bldg. LP-167-Door 13	4,048
PWIC-614 0221-7797	Bldg. LP-36	1,936
E-692096	Bldg. LP-21	1,595
PCV8395-01	Bldg. LP-167 Door 34	3,905
PAV1723-01	Bldg. LP-167 Door 13	4,048
PWC #355	Southwest Inside Bldg. V-4	1,870
PWC #356	Northeast Inside Bldg. V-4	1,870
F-959355	Front, outside Bldg. V-28	1,210
F-963420	Inside, Northwest Bldg. V-28	1,870
7015400	Vault outside Bldg. V-28	2,596
F-950356	Vault outside Bldg. V-28	1,210
F-52759464P	Padmount Bldg. V-9	6,776
PWC #333	Bldg. V-43	1,276
PWC #357	Cage Bldg. V-60	2,420
PWC #343	Northeast Corner Bldg. V-90	1,276
PWC #342	Comp Room Southeast Bldg. V-90	2,420
H-26704269	Outside Bldg. V-146	583

Source: Modified from EPA, Region III, Central Regional Laboratory, 1982.